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A REVIEW OF CONTAINER GLASS COMPOSITIONS 1940-1950

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I. Introduction

Analytical data and measurements of physical properties for a large proportion of the container glasses have been collected each year since 1932.[1,2,3,4] The individual tabulations are, of course, confidential, but there is a great amount of information in the form of summaries and charts that can be presented without revealing sources. While not all of the furnaces engaged in the manufacture of glass containers are represented in the yearly summaries, the large size and randomness of the sample appear to assure a satisfactory cross-section of the industry.

The purpose of this report is to show the trends of glass compositions from 1940 to 1950, and to show also the range of compositions and of physical properties of glasses in use during 1950.

II. Container Glasses 1940-1950

(a) *Major Oxides.* To simplify presentation, the constituents are grouped. Silica is considered alone. Alumina, lime, magnesia, and barium oxide are grouped as stabilizing oxides. Alkali, boric oxide, sulfate, and fluorine are combined as fluxes. The average percentage contents of glasses for these three groupings for each year from 1940 to 1950 are presented in Table I.

The silica content declined steadily from 72.9% in 1940 to 72.1% in 1946. However, the shortage of soda ash in 1947 and 1949 resulted in the substitution of silica for alkali. Since 1948, the percentage of silica has returned to the 1946 level.

The total of the stabilizing oxides has increased steadily from 10.9% in 1940 to 12.6% in 1950.

The alkali and minor constituents were nearly constant at 16.0% for the period 1940-1946, and then decreased from 1946 to 1950 to 15.4%.

TABLE I

AVERAGES OF THREE MAJOR GROUPINGS 1940-1950

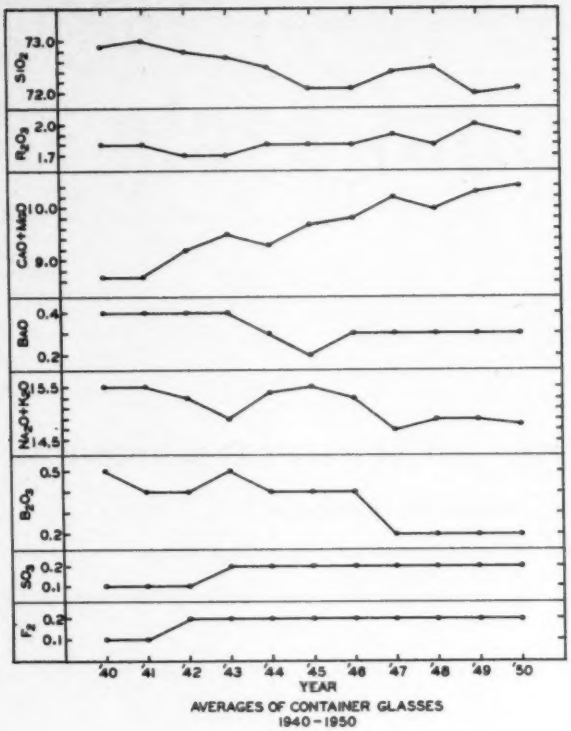
Year	Silica	Stabilizing Oxides	Fluxes
1940	72.9%	10.9%	16.2%
1941	73.0	10.9	16.1
1942	72.8	11.3	16.0
1943	72.7	11.6	15.8
1944	72.5	11.4	16.2
1945	72.1	11.7	16.3
1946	72.1	11.9	16.1
1947	72.4	12.4	15.3
1948	72.5	12.1	15.5
1949	72.0	12.6	15.5
1950	72.1	12.6	15.4

(b) *Minor Constituents.* The changes in the percentage of the minor constituents during the past ten years are perhaps more significant than the changes in the three major groupings. The individual percentages for all constituents by years are shown in Figure 1. It can be seen that barium and boric oxides have decreased, while sulfate and fluorine have increased, and alumina has remained nearly constant.

The percentages of alumina for the period 1940 to 1950 range from 1.7 to 2.0, the change from year to year not exceeding 0.2%. All the glasses analyzed during this period contained alumina as a purposely added constituent. The chief value of alumina in glass is to improve chemical durability, but in some instances it is used to modify working properties. The maximum resistance to chemical attack by water is attained when the per cent alumina is approximately one-eighth the per cent alkali.

The average content of barium oxide decreased from 0.4% to 0.3% in 1944. It has remained at 0.3% with the exception of one year, 1945, when the percentage dropped to 0.2. About sixty-five per cent of container

[1] H. Moore & A. K. Lyle—"Container Glass Compositions 1932-1946", Glass Industry, Vol. 28, No. 11, Nov. 1947.
[2] A. K. Lyle & A. G. Allen—"Container Glass Compositions 1947", Glass Industry 29, 9 (493-494), Sept. 1948.
[3] P. A. Webster & H. Moore—"Container Glass Compositions 1948", Glass Industry 30, 12 (657-659), Dec. 1949.
[4] A. L. Bracken, Jr. & P. A. Webster—"Container Glass Compositions 1949", Glass Industry, Vol. 31, No. 12, Dec. 1950.



AVERAGES OF CONTAINER GLASSES
1940 - 1950

Fig. 1.

glasses contain barium oxide as an added constituent.

Boric oxide, which was one of the first minor constituents to be advocated for improving both chemical durability and meltability of glasses, was used in 45% of the glasses made in 1940. Approximately thirty-five per cent of the glasses in 1950 contained boric oxide. The average percentage has decreased from 0.5% to 0.2% during this period.

The use of fluorine as an added minor constituent has grown remarkably from 1940 to 1950. Five per cent of the 1940 glasses contained fluorine, compared to 90 per cent of the 1950 glasses. The average fluorine content has increased from 0.1 to 0.2% during this period. Fluorine is added to the batch as fluorspar, sodium-silico-fluoride, or fluorbarite.

Sulfate has been found in all of the flint and green glasses made from 1940 to 1950. The average percentage increased from 0.1 to 0.2 in 1943 and has remained at this average percentage. Sulfate, represented by salt cake and barium sulfate, principally, is the effective fining agent in most commercial container glasses.

III. 1950 Glasses

The average composition for container glasses manufactured in 1950 is shown in Table II. Eighty-five furnaces are represented. While these are less than fifty per cent of the 210 furnaces engaged in manufacture of containers, more than half the manufacturers are repre-

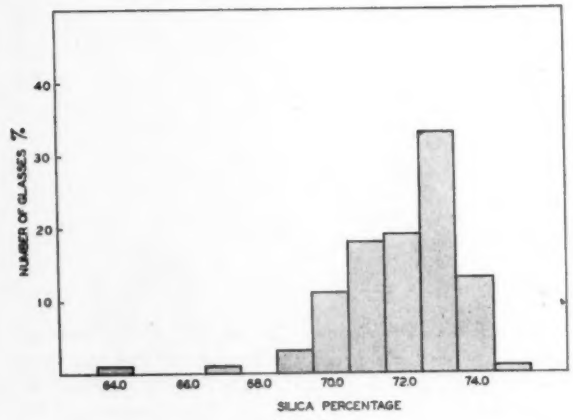
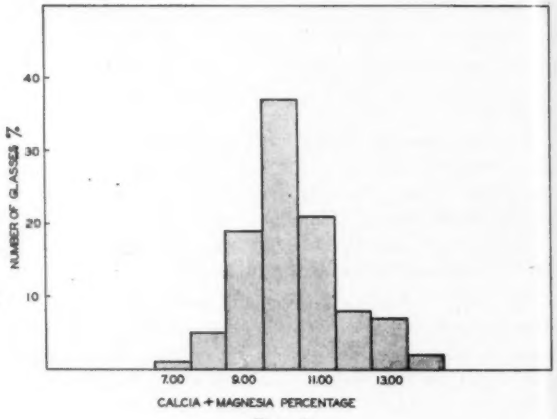


Fig. 2.



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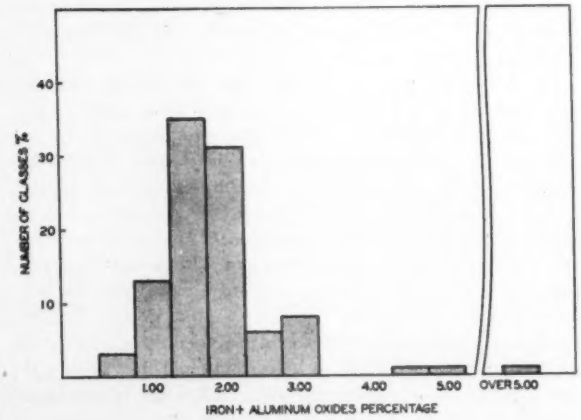

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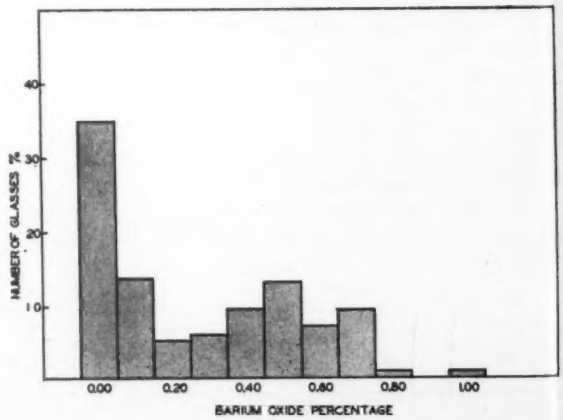


Fig. 5.

sented. No attempt has been made to weigh the results according to the amount of production represented.

TABLE II

AVERAGE COMPOSITION OF CONTAINER GLASSES MADE IN 1950

Oxide	%	%	
Silica, SiO_2	72.1	72.1	
Alumina, Al_2O_3	1.9		
Calcia, CaO	8.4		
Magnesia, MgO	2.0	12.6	(Stabilizing Oxides)
Barium oxide, BaO	0.3		
Sodium oxide, Na_2O	14.4		
Potassium oxide, K_2O	0.4		
Boric oxide, B_2O_3	0.2	15.4	(Fluxes)
Sulfate, SO_3	0.2		
Fluorine, F_2	0.2		
Iron oxide, Fe_2O_3—Flint Glasses		0.050	
Sulfur, S —Amber Glasses		0.03	

Sixty-five per cent of the glasses represented in Table II are flint, twenty-five per cent are amber, and ten per cent are Georgia or Emerald Green.

IV. Range of Composition

The range in compositions used in 1950 is presented by distribution charts which show the spread in composition.

The distribution of the various oxides and the effect of each on the physical properties of the glass are discussed in the following sections.

(a) *Silica.* The silica content, shown in Figure 2, ranges from 64.0 to 75.0%. The most common percentage is 73.0. If the glasses made with high-alumina sands, and therefore low in silica, are excluded, the average silica percentage is nearer 73.0 than 72.0. Glasses containing reasonably high percentages of silica are preferred because of ease in fining at high rates of furnace pull and of the generally higher forming rates. Improved chemical durability, thermal expansion, and low batch costs are also realized from glasses containing high silica.

(b) *Alumina.* The distribution of the percentages of alumina is shown in Figure 3. The most common percentage is 1.5. The value of alumina as an aid to improved resistance to chemical attack is well-known.

If the glasses containing less than 1.0% alumina, in which durability is apparently no problem, and glasses containing more than 2.5% alumina (these glasses make use of high alumina sands for economy) are excluded, the average alumina is precisely 12.5% of the average alkali content which proportion has been shown to produce maximum resistance to chemical attack by water[1].

[1] "The Effect of Alumina Upon The Chemical Durability of Soda-Lime Glasses", A. K. Lyle, William Horak, D. E. Sharp, Journal American Ceramic Society 19, 142-7, (1936).

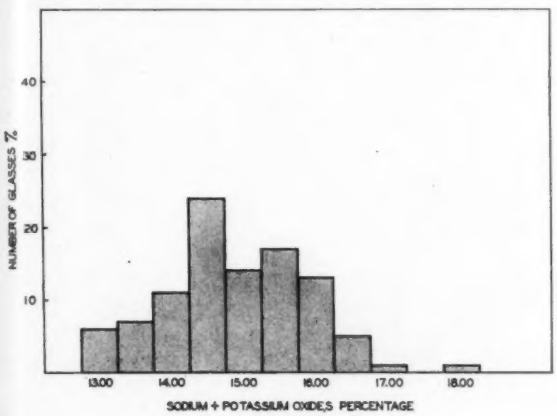


Fig. 6.

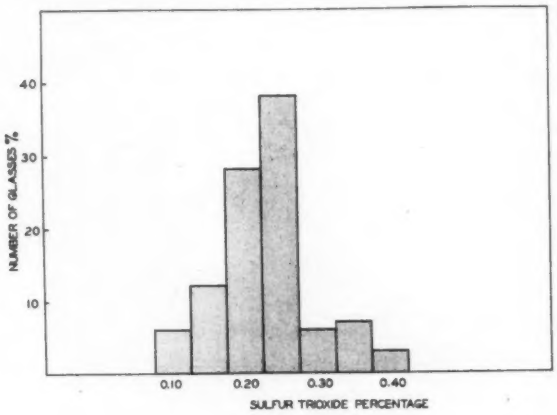
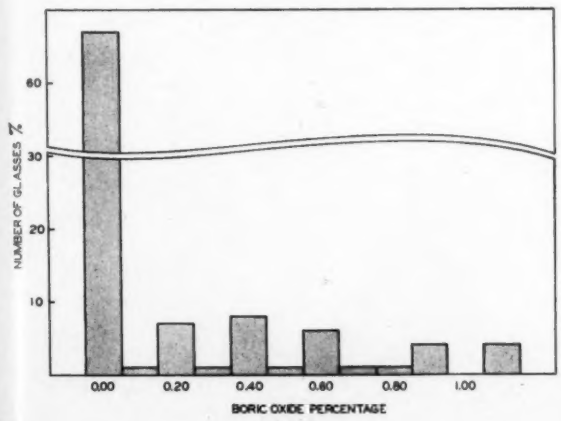


Fig. 8.



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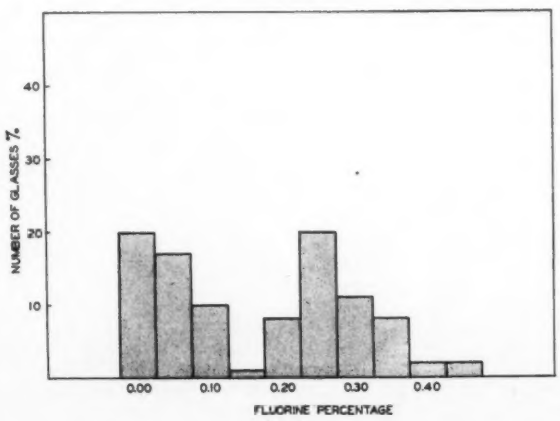


Fig. 9.

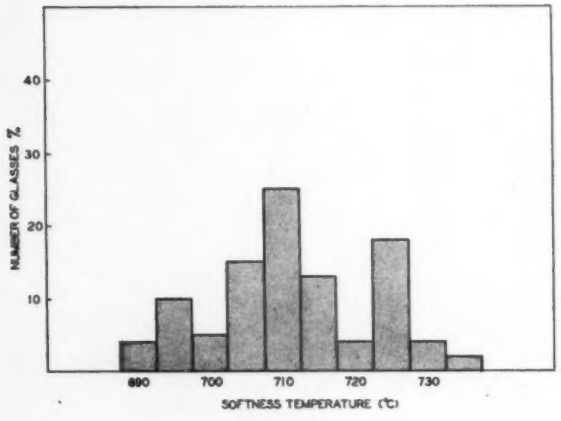
(c) *Calcia and Magnesia.* The total calcia plus magnesia for all glasses is shown in Figure 4. The most common percentage is 10.0, and the average is 10.4%. The trend toward higher lime is shown in that forty per cent of the glasses contain 11.0% or more calcia plus magnesia. About three per cent of the glasses contain 14% "lime."

It is apparent from the composition of the individual glasses that the difference between calcium oxide and magnesium oxide is being realized and being put to use in formulating improved modern container glasses. Glasses made with calcite limestone are desirable because they require relatively low feeding temperatures and less heat extraction for a given change in viscosity. This allows for maximum forming rates at minimum feeding and forming temperatures. However, the maximum percentage of calcia, and the maximum forming rates are limited because of the tendency toward devitrification of the glass at low feeding temperatures. Dolomite glasses (7:5 calcia-magnesia ratio) require higher feeding temperatures than those required for calcite glasses having similar forming rates, and also show less tendency toward devitrification at low feeding temperatures. However, because high feeding temperatures present a problem in excessive mold temperatures, glasses containing a mixture of calcite and dolomite limestone are most desirable. The trend toward this type of glass is evident in the 1950 glasses.

(d) *Barium Oxide.* Barium oxide, in amounts greater than 0.05%, is found in sixty-five per cent of the glasses, according to Figure 5. Because 0.05% BaO represents less than two pounds of barium sulfate or carbonate per ton of glass, it is assumed that percentages of 0.05 or less do not represent barium oxide as an added constituent. It is probable that these small amounts are introduced as foreign cullet. The average barium oxide content is 0.43% in glasses containing purposely added amounts.

For all practical purposes, barium oxide, in amounts less than one per cent, may be considered a part of the lime. The use of barium in small proportions is for improved fining rather than for any effect on working properties. Retention of sulfate is greater when barium is present and therefore provides for more efficient use of sulfates.

(e) *Sodium and Potassium Oxide.* The percentage of sodium plus potassium oxides ranges from 12.8 to 18.0, the most common being 14.5%. From the distribution chart, Figure 6, it can be seen that an equal number of glasses contain amounts greater and less than 14.75%. The cause of this distribution can be explained. At high rates of pull, between 17 and 25 tons per 100 square feet of melting area, the low-alkali glasses have faster fining rates than those glasses containing relatively large percentages of alkali. Most of the high alkali glasses have a fining advantage at low furnace rates. Demand for greater resistance to chemical attack, shortage of soda ash, and the advantage of increased forming



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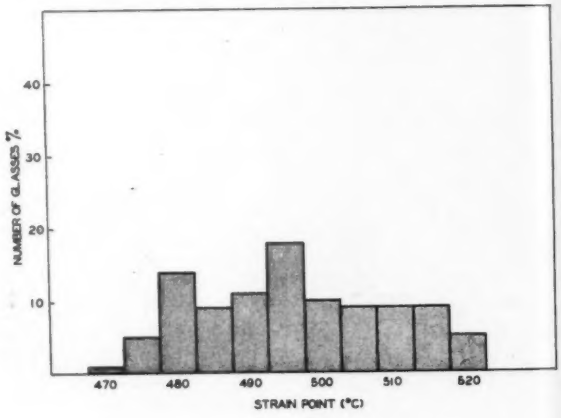

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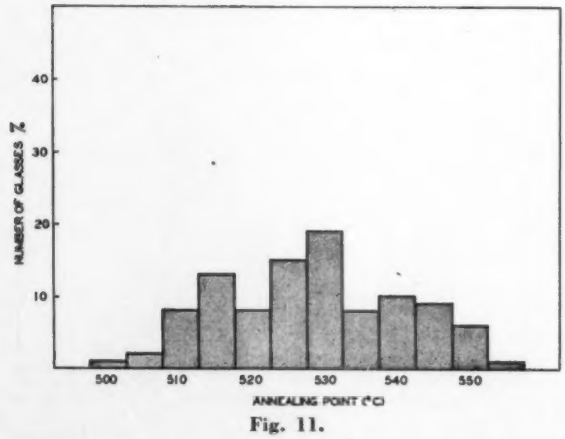

Fig. 11.

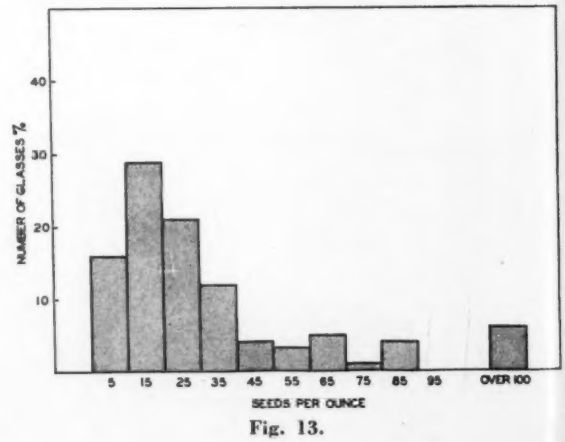

Fig. 13.

rates are other reasons for the trend toward lower alkali glasses.

(f) *Boric Oxide.* Boric oxide in amounts greater than 0.05% is found in thirty-five per cent of the glasses, Figure 7. The boric oxide in approximately one-third of these is introduced as an impurity in the soda ash. Therefore, only 20% of the glasses contain boric oxide as an added constituent.

The average boric oxide percentages in glasses containing more than 0.05% is 0.50. Since other materials can be used to obtain properties similar to those effected by boric oxide, its use is limited by high cost. However, because of the increased demand for containers having extremely high resistance to chemical attack and to thermal shock, the use of borax in the production of container glasses seems to be increasing.

(g) *Sulfate.* Sulfur trioxide is found in all flint and green glasses. The percentages range from 0.08 to 0.40. This is shown in Figure 8. Sixty-five per cent contain between 0.20 and 0.30%, and the most common group is 0.25%. The sulfate is usually introduced as salt cake or barytes.

The value of sulfate as an aid in fining is well-known. Amounts greater than 0.40% are not found.

(h) *Fluorine.* Fluorine in amounts greater than 0.05% is found in 80% of the glasses, Figure 9. The average percentage for glasses containing more than 0.05% is 0.22%.

The distribution of fluorine in two groups, from 0.05 to 0.15% and from 0.20 to 0.40%, can be accounted for. A small percentage of fluorine in the glass can increase the fining rate considerably. Greater amounts increase the fining rate only slightly more. Fluorine also lowers viscosity. If lower viscosities are desirable, greater percentages of fluorine are used. However, since lower viscosities usually result in lower forming rates, the higher fluorine percentages are not always desirable.

TABLE III

PHYSICAL PROPERTIES OF AVERAGE CONTAINER GLASS 1950

Softness Temperature, Log Viscosity 7.65	712° C.
Annealing Point, Log Viscosity 13.4	528° C.
Strain Point, Log Viscosity 14.6	496° C.
Coefficient of Thermal Expansion 0-350° C. x 10^{-7}	88.9
Density, grams per cc at 20° C.	2.4910
Seeds per ounce of glass	30
Blisters per ounce of glass	3
Homogeneity, ring section grade	B to B—

V. Range of Physical Properties

Measurements of physical properties, including low temperature viscosities, densities, homogeneity, thermal expansion, and concentration of seeds and blisters, were

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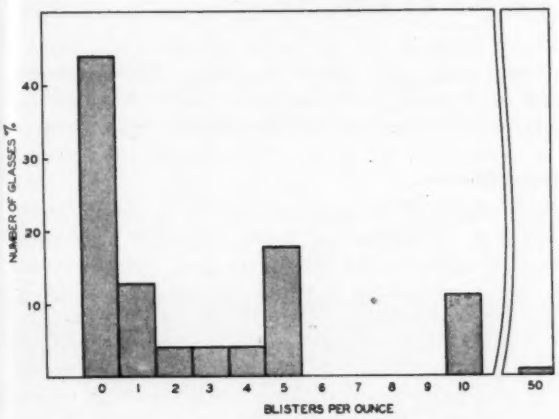

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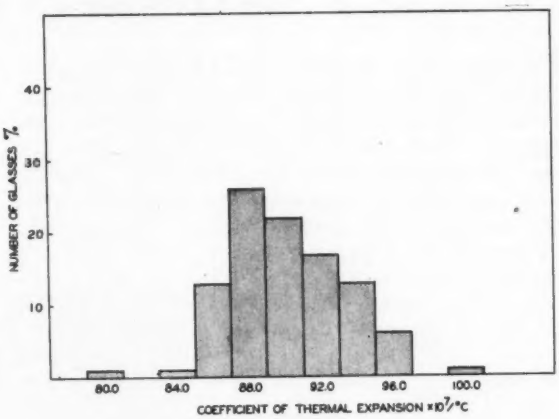

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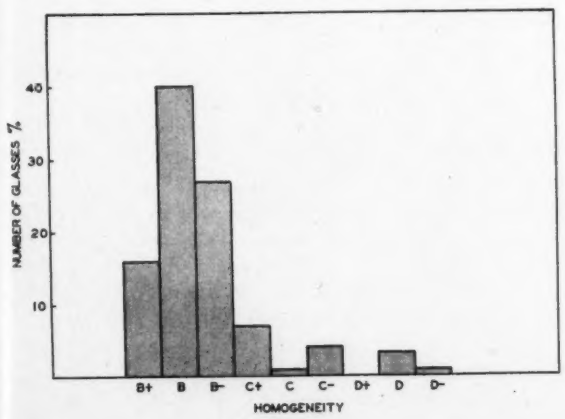

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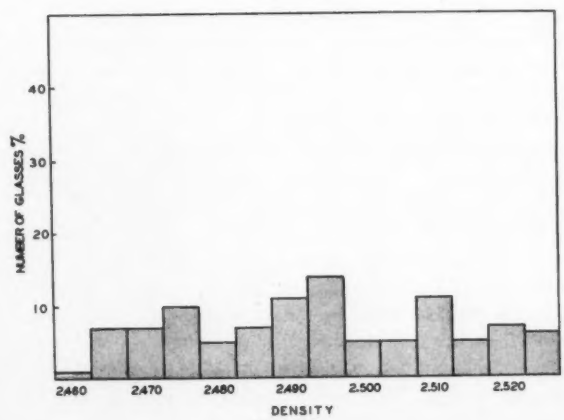

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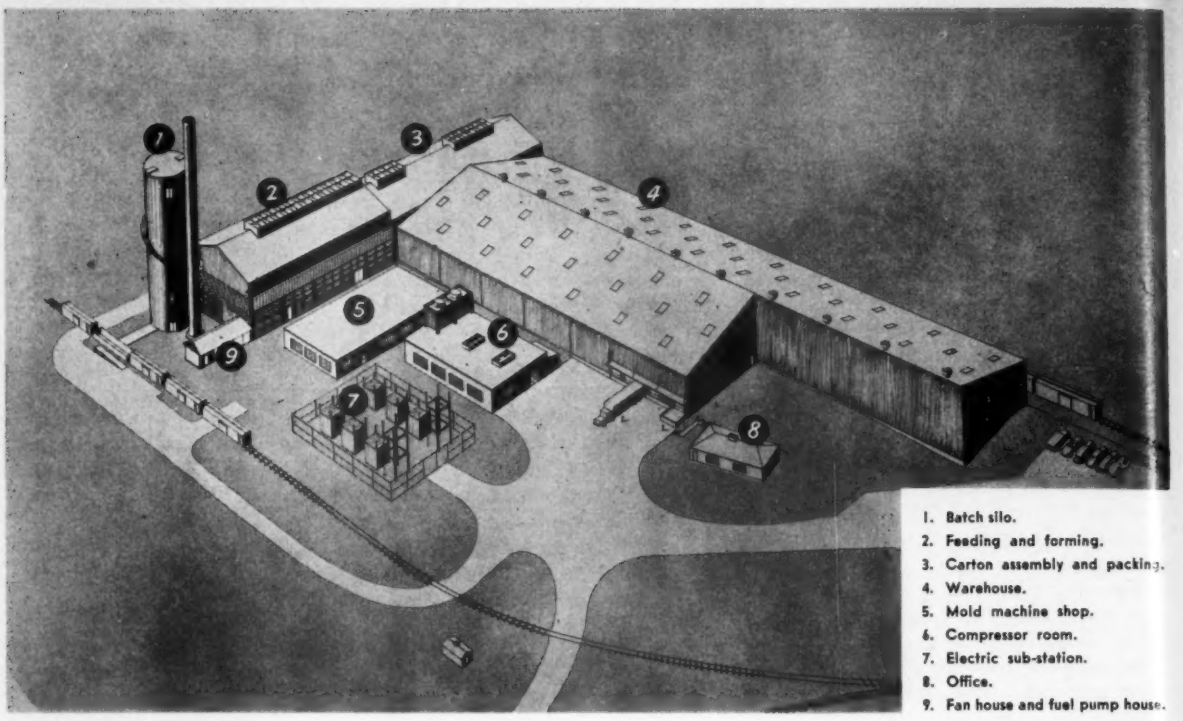


1. Batch silo.
2. Feeding and forming.
3. Carton assembly and packing.
4. Warehouse.
5. Mold machine shop.
6. Compressor room.
7. Electric sub-station.
8. Office.
9. Fan house and fuel pump house.

THATCHER IN LAWRENCEBURG

The newest plant of the Thatcher Glass Manufacturing Company, Inc., which started production in May at Lawrenceburg, Indiana, is designed to make all sorts of glass containers by straight line production with ample provisions for the health and safety of employees. It is spacious, airy, light, well ventilated, with production equipment and lines widely spaced. Wherever consistent with accuracy of operation, operations are mechanical and automatic. It is situated on the main line of the New York Central between Cincinnati and St. Louis on 7,000 feet of spur track to the loading and unloading docks.

Structures

The main mill-type steel frame building which houses operations, from silo to packing, is 71′ 8″ wide by 241′ long. Sides and roofing are of corrugated aluminum. Accessory buildings, such as the machine shop and compressor room, are of concrete block. All have concrete floors and concrete foundations. Roofs are of the concrete slab type.

Harold N. Hermann & Associates of Cincinnati were the architects. Construction was by The Gillmore-Carmichael-Olson Co., Cleveland, which has built and modernized other Thatcher plants.

The center roof of the main building is ventilated by thirty-two 5′ x 10′ Swarthwout air mover units over the hot end, with 24 additional units above the packing area and the carton manufacturing mezzanine.

Large areas of the side walls are of Swarthwout adjustable louvers which give stack action from the side louvers to the roof vents. Conventional steel sash is used in the packing and carton mezzanine. The warehouse roof is of corrugated aluminum with corrulux panels inserted at intervals to provide adequate daylighting.

Batch House

The silo is 32′ in diameter x 86′ above ground level, extending 13′ below for the underground conveyors, handling materials fed by gravity from freight cars on the siding. It is bujlt of reinforced radial tile, 8″ thick on concrete foundations, with 6″ tile partitions. The silo capacity is 1300 tons and the furnace rate of pull is 100 tons per day. The landings on the outside steel stairs are located every 12 steps. Lever controls release materials from the locked storage bins to the Toledo scale, and thence into a Smith 56 cu. ft. batch mixer on ground level. Weighing is done manually. Jeffrey conveyors and elevator deliver materials to the batch cans which are confined to the charging floor and are carried on Cleveland Tramrail overhead equipment.

Charging Floor

The control room off the charging floor is equipped with Leeds and Northrup, Foxboro, and Brown controls. The furnace is side-fired, regenerative, and reverses the flow automatically every 20 minutes, with a daily consumption of about 650,000 cu. ft. of natural gas. The air reversing valve is a Blaw-Knox double deck type.

The furnace has electro cast side walls, bridge wall, back wall and throat; a clay bottom; and silica superstructure reinforced at ports 1 and 2 with electrocast jambs. It has basic port uptakes and checker spacing.

Charging floor.

Refractories are by several manufacturers. There is a wide steel grating walk between the furnace and the four checkers, ventilated for comfort. The stack is steel, brick-lined, 5′ x 150′.

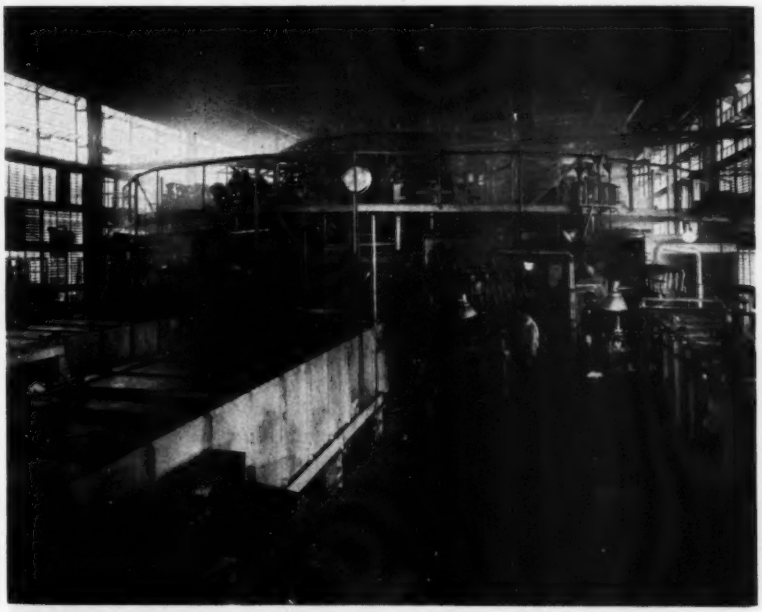
Feeding and Forming

Feeding and forming is done by four Hartford-Empire machines, widely spaced, with four spiral stairways to the forehearth. The steel grating catwalks with pipe rails are on about the same level as the charging floor.

There is no piping whatever above the machines. This area will be steam cleaned, scrubbed, and re-painted when the furnace is shut down for repairs or re-building. The entire interior is covered by aluminum paint. The four Hartford-Empire lehrs have a 76′ tunnel and a belt width of 43⅝″.

Selecting, Packing, and Warehousing

Skate wheel conveyors connect the lehrs with the packing tables, which are staffed by women. The continuous conveyors from the carton department on the mezzanine above converge at the tables with conveyors from the lehrs. The selection and packing tables are widely spaced and Roura hoppers for rejection are located between them. The hoppers are picked up periodically by Towmotor lift trucks, used throughout, to carry rejects to the yard where a scoop truck carries the glass to the



Cleanliness and good ventilation in the feeding and forming area.

The quality control laboratory.

underground conveyors and cullet cellar after a magnetic separation in process.

The filled cartons of containers are stacked on light pallets for warehousing. From this point on, the entire operation is palletized for the lift trucks which tier the finished product in the warehouse. The warehouse can handle ten outgoing railroad cars and four trucks simultaneously.

Four ABC packaging machines are located on the carton mezzanine above the packing department. This department, as are the packing tables, is also staffed by women.

Continuous conveyors coming from the carton department on the mezzanine converge at the end of the lehr.

Quality Control Laboratory

The quality control laboratory equipment at present includes a Preston pressure testing machine and density comparator. Thatcher has its own apparatus for thermal shock testing, graduation and gauging of bottles, alkalinity testing of glass, glass analysis, impact testing, and examination of ring sections. The laboratory includes a polariscope by the Polaroid Instrument Company for examining annealing stresses.

Accessory Buildings

A modern well-equipped mold and machine repair shop services the new plant. This shop is located alongside the factory on the same floor level, which facilitates the movement of mold equipment back and forth. The equipment is of the latest type; such as hydraulic milling machines and hydraulic lathes. Vapor Blast Manufacturing Company equipment is used for mold cleaning. A well-equipped tool crib is complete with steel shelving. The production office is in this unit. There are 3 Ingersoll-Rand synchronous motor driven units in the compressor room. The mold cooling blowers are Sturtevent, and the furnace cooling blowers are Buffalo Forge.

The water supply comes from one 125,000-gallon tank for sprinklers and a 150,000-gallon tank to supply operational uses.

The one-story office is situated in the L of the warehouse. All departments are headed by Thatcher men brought in from Thatcher plants at the Elmira, N. Y. headquarters, or from the plant at Streator, Ill. The Lawrenceburg plant will employ about 125 people. It is an unusually clean plant with big wash rooms and plenty of showers. There is an attractive rest and lunch room for women employees.

Thus far, production has centered upon amber glass liquor and beer bottles.

STACK CONDENSATION

By J. L. SAMPSON

Mahoning Glass Works, General Electric Company, Niles, Ohio

Editor's Note: In this brief article, Mr. Sampson outlines the troublesome problem of stack condensation in melting borosilicate glass.

In an effort to offer its readers a solution to the problem, The Glass Industry asked the opinion of a technologist who has had broad experience in the use of borax in glass. His opinion immediately follows Mr. Sampson's paper. The Glass Industry will welcome other comments on this subject from its readers.

The Mahoning Glass Works of the General Electric Lamp Department produces hard glass for sealed beam headlamps. This glassworks melts a borosilicate glass approximately 15% B_2O_3.

During a recent campaign, a rather unusual condensation developed in the stack. The furnace used at the Mahoning Glass Works is a conventional cross-fired regenerative tank. The stack is brick and is 150 feet in height, with an inside diameter of five feet. A stack damper to maintain desired furnace pressures is located immediately after the reversing valve.

When the campaign that produced this condition started, the flues to the stack and the base of the stack had been thoroughly cleaned. At the outset, the damper operated normally about one-third open. However, within a few months we found that it was necessary to gradually open this stack damper in order to maintain the same pressure inside the furnace. Just before the middle of the campaign, we had reached the point where it was necessary to operate with the damper wide open, and still the tank pressures were increasing beyond control. We shut the gas down and then, by removing some brick on the side of the flue beside the stack damper, we were able to look across the bottom of the flue at this point. We could see a deposit of sintered gray material all around the damper section. Below the damper the deposit was over a foot deep, and it appeared to be almost as thick on the sides of the flue.

We were able to remove a large portion of the material near the damper by using scrapers and hoes. We sealed up the opening, turned on the gas, and the furnace could be operated almost normally, with the stack damper about one-third open as it was at the start of the campaign.

A few months later, the operating condition repeated, the stack damper was again wide open and the furnace pressure was increasing. We again removed some brick at the side of the flue. This time we discovered very little deposit around the damper, but upon further investigation we discovered the same type of sintered gray material deposited along the entire length of the flue. However, this time there was a severe restriction on the top and sides of the flue where it entered the stack, caused by a substantial buildup. We also found that there was a large pile of this same material at the base of the stack. A temporary opening into the flue was made, fires in the tank were shut off, and workmen entered the flue and cleaned it out. After the deposit had been removed and the flue sealed up, the gas was turned on and again the furnace operated normally.

As the campaign progressed, for the third time we were forced to open the damper wide and still had the condition of increasing furnace pressures. A check this time indicated that we did not have any appreciable buildup in the flue. Yet, with each day it became increasingly difficult to get sufficient air into the furnace to burn the necessary fuel. We attempted to correct the condition by repeatedly burning out the regenerators which had become partially plugged, but this seemed to have no effect on the air flow.

Finally, one week before the tank was scheduled to be shut down for repairs, the furnace combustion was so bad that it was evident that we would not be able to run another week unless the airflow through the tank could be improved. We checked the draft pressures with an incline gauge at both the stack door about 20′ above the bottom of the stack and at the damper. This check showed almost an inch drop. Although we had no previous measurements to definitely determine whether or not this was about normal, we firmly believed that this was excessive and that a constriction existed between these two points.

Although there was practically no buildup in the flue, we elected to clean it out, with the hope of obtaining

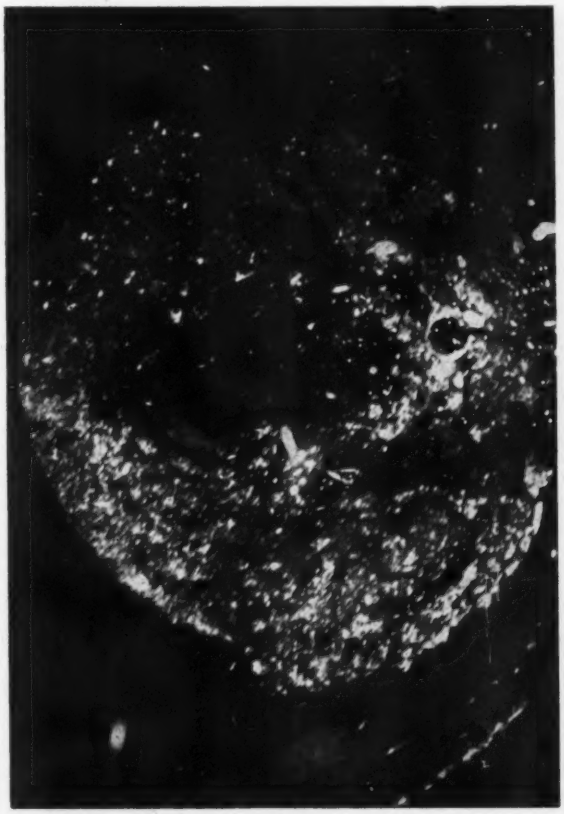


Fig. 1.

enough relief to run the tank the last week of the campaign. When the flue was opened, we walked in for a careful inspection. We discovered that there was little buildup clear up to the stack—certainly not enough to cause the existing difficulty. However, when we entered the base of the stack and looked up, we saw an unbelievable buildup around the inside of the stack about 10 feet above the base. This buildup was so great that the five-foot diameter of the stack was constricted to an oblong opening about 1′ wide and 2′ long. (See Fig. 1.) The buildup resembled a thin shelf a couple of inches thick at the edge of the opening and tapering inward to about a foot thick where it was attached to the inside of the stack.

We used rods and two-by-four timbers to knock the larger part of this buildup down. We sealed the flue and operated the tank on a normal basis again for the balance of the campaign. The stack damper again operated at only about one-third open.

The following week the tank was shut down for repair, and this gave us an opportunity to thoroughly inspect and clean the stack. In addition to the constriction we just described, we discovered that there was another buildup of material that had started about one foot from the top of the stack. This buildup was about a foot thick and extended down into the stack about four feet. In addition, throughout the entire length of the stack there was a buildup of about one to two inches in the form of concentric rings.

Incidentally, although the flue to the stack had been cleaned at the end of each campaign, this was the first time it had been necessary to clean the stack since it had been constructed in 1939. Our inspection further showed that the flues from the reversing valve to the regenerators had no buildup.

Analysis of the material removed from the flue shows that it is about one-third B_2O_3, one-third arsenic, and the balance sulphur and miscellaneous batch materials. The glass itself contains only about ¼% arsenic.

* * * * *

CONDENSATION IN GLASS TANK CHECKER, FLUES, AND STACKS

Melters of borosilicate glass have always been confronted with the formation of deposits in different places in the system. Many operators have come to accept their occurrence as an evil which must be lived with, placing them in the same category and a bedfellow to the dusting problem of the lime glass melters.

The location and formation of the deposits seem to differ in individual systems and apparently are dependent on variables which include modifications in tank design connecting checkers, flues and stack, operation of the tank, and raw materials used. In many systems the deposits build up in the checkers. Frequently they occur in the flues and occasionally condensation takes place in the stacks.

The physical properties of the two major constituents of these deposits, it is felt, give the clue to an explanation of their formation. Both boric acid and arsenic are quite volatile. Boric acid is used as a supplementary source of B_2O_3, with borax in the borosilicate batch and has the following composition: B_2O_3, 56.3% and water, 43.7%. Its melting point is approximately 339°F. When heated above 212°F., some of its water of crystallization is driven off. On continued heating, more water is driven off and metaboric acid (HBO_3) with melting point at about 457°F. is formed. Further heating results in anhydrous boric acid (B_2O_3) melting at 842°F. Under certain conditions B_2O_3 can be volatilized with water. This happens if a concentrated water solution of boric acid is boiled for a prolonged period of time. Some loss of B_2O_3 could readily take place shortly after the batch is fed into the furnace and the boric acid starts to melt either in its own water of crystallization or water liberated from any other batch constituents. Secondly, the boiling point of B_2O_3 is reported as 1500°C. (2732°F.), which is below the operating temperature of 2850°F. found in many borosilicate tanks. Uncombined B_2O_3 subjected to temperatures in excess of its boiling point would result in some loss by volatilization. (It has been noted that tanks not being pulled to capacity, resulting in prolonged retention time of melted glass, show increased losses of B_2O_3.) The low sublimation temperature of arsenic and many of its compounds are well-known. Conversely, redeposition of both B_2O_3 and arsenic would be expected at any location in the checkers, flue, or even in the stack when temperature of the gases drops to a point where the volatile constituents will condense. Under certain conditions where checker and flue temperatures are high, condensation might not take place until gases reach the stack.

Until such time as batch constituents are water-free and volatile constituents are introduced in a combined state to render them less volatile, one will have to live with the evil and attempt by manipulation of furnace operations and strategic location of clean-out ports to handle these objectionable deposits in such a way as to obtain minimum production interruptions.

TOLEDO CHOSEN IN PROMOTION OF ONE-WAY GLASS BOTTLE

Toledo has been selected as one of five "seed-bed" cities in the U. S. for long range promotion of one-way glass beer bottles, according to L. N. Crossley, Manager of Owens-Illinois Glass Company's Brewery Division.

The Toledo promotion of the throw-away bottle will include a jingle contest offering $3,500 in prizes with a first prize of $500. Contest period runs from July 20 through August 20, 1951.

Other cities picked by O-I for the throw-away bottle campaign are Indianapolis, Memphis, Columbus, and the San Francisco-Oakland area.

• W. H. Howe, Chief Engineer of The Foxboro Company, will be in general charge of arrangements for the High Pressure Symposium scheduled to be held during the Annual Meeting of the Industrial Instruments and Regulators Division of the American Society of Mechanical Engineers on September 8 through 12, 1952.

EAST ASIATIC GLASS

By DOROTHY BLAIR

PART III—JAPAN

The history of Japan (that is, the record of rulers), according to tradition, began in 660 B.C., but this date has been moved up by scientific reasoning to approximately the beginning of the Christian era. The history of glass in Japan must begin at about the same time since glass objects, especially beads, have been recovered from tombs of the Proto-historic Period (before about 552 A.D.). In at least one instance they came from graves (at Okamoto in Kyushu) assigned with plausibility to the interval from 100 B.C. to 100 A.D. Included were a glass disc, *pi*, of the Chinese Han Dynasty style, many small beads, and one glass *magatama* bead. Since the *magatama* is peculiarly Japanese (and South Korean) and was used prolifically in the Proto-historic Period, and since small glass beads of varying color have been found in quantity in graves of the period, it would seem credible that they were produced in Japan, although details of the origin of glassmaking in Japan are unknown.

Magatama ("curved jewels") were referred to in Part II of this series,[1] but their use in Japan differed from that in Korea. Several glass *magatama* are shown in Figure 1. According to mythology, the deities in high heaven presented to the heavenly grandson, who became the first Japanese emperor, when he descended to earth, a sword, a mirror and *magatama*—three forms which have remained the imperial insignia through the centuries. In early literature there are references to "jewel strings" which were made up of *magatama* and other beads and used in necklaces, ear ornaments, armlets, and anklets. Many modeled clay figures, called *haniwa* and associated with early tombs, are shown with just such strings of beads (Fig. 2) and because these representations are fairly common the quantity of actual beads remaining from this early era is not surprising.

Most of the actual *magatama*, to be sure, are carved from minerals, but examples also exist in blue, green, and colorless glass. Innumerable other glass beads of the period have been excavated (Fig. 1). They are chiefly dark blue, but sometimes green or colorless, and occasionally yellow.

Actual evidence of local glassmaking has been unearthed at Tamatsukuri in Izumo Province in western Japan, famous for centuries as a bead-working center. Figure 3 shows part of a clay melting pot found there, with melted glass still remaining in the bottom and a lump of green glass found with it. The probable date is fifth or sixth century. Japanese scholars assign nothing earlier than the latter fifth century for the real beginning of Japanese glassmaking as an industry.

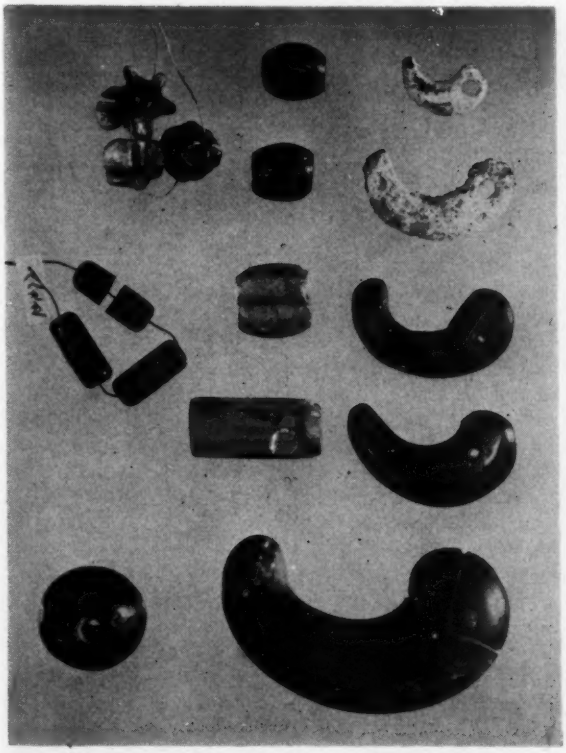


Fig. 1. Various Beads, representative of Proto-historic Period (Before 552 A.D.) ***Courtesy of the National Museum, Tokyo.***

Fig. 2. Clay *haniwa*, with necklace of *magatama* and tubular beads. Proto-historic Period (Before 552 A.D.). ***Courtesy of the National Museum, Tokyo.***

Fig. 3. Fragment of a clay melting pot with adhering melted glass, and lump of green glass found with it. 5th or 6th Century A.D. ***Courtesy of the National Museum, Tokyo.***

Fig. 4. Cinerary Urn of Green Glass. Early 8th Century A.D. ***Courtesy of the National Museum, Tokyo.***

Vessels of glass dating from this period are rare, but in the tomb of Emperor Nintoku (died c. 427 A.D.) there were found, in 1872, broken glass vases. These were replaced in the repaired tomb with no visual record made of their appearance. Another glass bowl came from the tomb of Emperor Ankan (died 535 A.D.) and has now become an important link in the history of glass in Japan. It was found in the crumbled soil of the flood-damaged tomb around 1720 A.D. A rough sketch (now considered misleading) was made of it at the time.[2] Until quite recently this offered the sole visual knowledge of the bowl in modern times, as its whereabouts subsequently became unknown. Now the bowl has been rediscovered, identified, and published. In August 1950 it was presented by its owner to the National Museum in Tokyo. The author of a detailed treatise based on supporting literary, historical, and archaeological data, and on the documentary evidence of an inscription on the storage box concludes that there can be no doubt regarding the authenticity of the bowl.[3]

The bowl, approximately three and one-quarter inches high, is of translucent glass, slightly brownish in tone. It had been broken into ten pieces, and is repaired with lacquer, several missing parts being filled in with lacquer. The surface is cut with a pattern of adjoined facets. One interesting aspect of this find is its similarity to a bowl in the Shosoin, an eighth century imperial treasury (cf. Fig. 7) which has always been assumed to date from that time. However, Dr. Sueji Umehara was assigned the unprecedented privilege of examining these two bowls, side by side, and found them to be of the same size, same general aspect and pattern, same technique, and evidently from a common source. Since the Emperor Ankan's tomb is unquestionable, it would seem that both bowls must date from no later than the early sixth century, or somewhat earlier. They are apparently of Persian or Syrian origin. Not only was this a popular design in ancient cut-glass of western Asia, but fragments of similar work have been found at sites in Central Asia, manifesting its migration eastward. The possibility of imitative production in eastern Asia, perhaps by western craftsmen, is not to be ruled out, but considering the international intercourse across Asia in the early centuries of our Christian era, the bowls were quite likely importations, probably through Korea, and very likely the gift of royal envoys to Japan.

A cinerary urn of blown green glass from Hachiro in Nara Prefecture (Fig. 4) suggests a local, or at least East Asian, source, since it has not the symmetrical perfection of the Roman or Syrian form and seems to have been rather experimental. It had been interred in a gilt-bronze box, together with a bronze inscription giving the name of the deceased and dated as of our 707 A.D.

With the coming of Buddhism to Japan in the sixth century A.D., and during the Asuka and Hakuho Periods (552-710 A.D.), we find indications of the rare value assigned to glass vessels, in the small glass pots used as receptacles for the most sacred Buddhist relics, the pot itself being encased perhaps in several outer receptacles of varying precious metals.[4] Such relics were sometimes buried under pagodas, as at the temple Horyuji, or beneath altars. However, it seems quite likely that these early glass reliquaries were brought, with their contents, from the continent.

At any rate, by the Nara Period (710-798 A.D.) glass-making had reached a level of high excellence and—thanks to some of the temple and shrine treasuries and to the unique eighth century "museum", the Shosoin in Nara, housing the possessions of the Emperor Shomu—we are able today to study many fine specimens, both imported and of Japanese make. There are beads in preponderance—over 62,000, as such, in the Shosoin alone, in addition to many used to embellish other objects, and quarts of broken specimens. They are well formed, skillfully polished, and carefully bored. Colors now included dark blue, light and dark green, yellow and brown, besides opaque white and colorless glass. Some

examples, called "dragonfly" beads, are patterned in a blending of colors. Several of the poems of this Nara Period refer to strings of beads: as, "If he were a jewel, I should wear it, winding it round my arm."

Beads were now, if not before, also used as attached ornament. The handsome crown of a revered temple statue of dried lacquer, heroic in size, owned by the temple Todaiji in Nara, is resplendent with colored and colorless beads, many of which are of glass threaded on silver wire. Glass beads were also strung on silver wire and fashioned into "baskets" which held the flowers to be scattered during Buddhistic rituals; the beads are strung in symbolic graded color arrangements. Other objects, including canopies over sculptured figures, had strings of colored glass and other beads suspended from them. Buddhist rosaries also often included glass units.

Glass insets were inlaid in sword scabbards, in knife sheaths, and in symbolic ceremonial accessories. The ends of the rods on which scroll paintings and calligraphic documents of the time were rolled were often of glass. There are many of these in the Shosoin, of blue, brown, green, yellowish and a translucent creamy glass. There are game counters in blue, green, and yellow; and even a few decorated rulers of glass. Some of the objects, in all probability, were importations from China or Korea, but others may be assumed to be of local production.

Fig. 6. Dark Blue Glass Cup on Silver Foot in the Shosoin, Nara. Eighth Century A.D. or Earlier. ***Courtesy of the National Museum, Tokyo.***

Fig. 5. Glass Ewer in the Shosoin, Nara. Eighth Century A.D. or Earlier. ***Courtesy of the National Museum, Tokyo.***

There are also in the Shosoin collection a number of blown and cut glass vessels which are more controversial as regards origin. Figure 5, an almost colorless but faintly green ewer, is reminiscent of Persian traits and is similar in some details to other forms in the Shosoin which suggest a Persian influence, if not a Persian provenance. The ewer might possibly even have been made in China, as China was greatly influenced by Persian culture at this time and just previously.

The bowl of Figure 7, with hollow-ground facets, has already been mentioned in connection with the practically identical bowl from the tomb of Emperor Ankan. Long considered as more or less contemporary with the mid-eighth century founding of the Shosoin, it would now seem to be between at least two and three hundred years earlier. If this is true, then could not some of the other western style glass vessels of the Shosoin also be of earlier date? They may have been cherished and treasured through generations of the royal family before coming to rest in the famous storehouse. It is an interesting thought as related to early international relations.

There are other glass vessels which, like these two, have reposed in the Shosoin for twelve centuries, preserved there with care and devotion, and even kept from the light most of the time in a building whose planned

construction itself gave ingenious and natural air conditioning.

For the Heian Period (798-1186 A.D.) there are several references to glass in the famous early eleventh century novel, *Genji Monogatari* (The Tale of Genji), dealing with court life of the time. One refers, for instance, to a gift of glass bowls filled with balls of incense; another, to glass used with gold and silver foil as decoration on an item of apparel. It was during this period that an imperial edict restricted to sixty strings of prescribed length the number of strings of glass beads which might be presented to the Emperor annually by the bead workers of Izumo Province—an action indicative of a sizable output in that industry.

In succeeding centuries glassmaking seemingly diminished considerably, and apparently the process of blowing glass had never secured any foothold in Japan before the importation of European glass after the opening of the port of Nagasaki to Portuguese trade in 1750. Japanese artisans then learned the technique, though it seems to have been pretty much confined to small glass factories and itinerant glass workers. Small shops sprang up in some cities. Beads were popular still for Buddhist rosaries and for decorative use. Many of the beads were now decorated after the European manner. But other objects came to be made of glass: women's decorative combs occasionally, both plain and carved, for use in coiffures; glass inlays in lacquered *inro;* inexpensive glass substitutes for counters used in the Japanese chess; the glass musical toy, *pompin* or *pokon-pokon* (similar to the Chinese toys), fashioned of very thin glass with a flexible bottom which bulged out when air was blown in and receded inward when the air was sucked out. Probably some of the transparent blown glass vases, fishbowls, and other receptacles represented in Japanese wood-block prints and paintings were local productions, although it is known from such records as ships' inventories that some European glass was imported.

In this present era, since 1868 A.D., and particularly in recent decades, the commercial glass industry in Japan has made great strides. Products include practically every form of glass and before the war were exported in quantity. Some of the artistic productions of recent years have been very successful. Figure 8 presents a modern version of the facet pattern (compare with Figure 7) which is in no way an imitation of a centuries-old design but entirely representative of the modern spirit. A new technique of fusing glass of five colors has also produced some interesting items. Glass has today become an integrated part of Japanese life and art.

Fig. 7. Cut Glass Bowl in the Shosoin, Nara. Eighth Century A.D. or Earlier. ***Courtesy of the National Museum, Tokyo.***

Fig. 8. Modern Crystal-Glass Bowl with Cut Design. ***Courtesy of the Iwaki Glass Co., Ltd., Tokyo.***

FOOTNOTES

[1] The Glass Industry, August 1951, p. 402.

[2] cf. Kosaku Hamada and Sueji Umehara, A Royal Tomb "Kinkan-tsuka" or The Gold Crown Tomb at Keishu and Its Treasures. Special report of the Service of Antiquities, Vol. III, Government General of Chosen (Korea), Fig. 21. (After an early sketch in the *Shukozu*).

[3] Kazuo Fujisawa, *Hari-wan no Kyoi* (A Sensational Glass Bowl), in the new periodical *Ashikabi*, No. 1, April 1951. The author refers to a previous article on this bowl by Dr. Mosaku Ishida in the *Kokogaku-zasshi* (Archaeological Journal), November 1950—which, I have not as yet seen.

[4] cf. Bulletin of Eastern Art (Tokyo), No. 17, May 1941, pp. 31-32.

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Seligman, C. G. and Beck, H. C.: Far Eastern Glass Some Western Origins. Bulletin No. 10, The Museum of Far Eastern Antiquities (Stockholm), 1933, pp. 57-58.

The Toledo Museum of Art: Exhibition of East Asiatic Glass, October 1948.

GAS DELIVERY LIMITATION

Effective August 22, a government order just issued limits the delivery of natural gas for new spaceheaters and large volume users in certain areas.

Among the areas to be affected (states of interest to glass manufacturers listed only) include: Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, West Virginia (only portions serviced by Columbia Gas System and its subsidiaries), and Wisconsin.

There are hardship exceptions stated in the order, but the deadline is generally set to refuse natural gas supply to large volume customers for new equipment installed after August 22, 1951, unless it replaces formerly installed equipment and then within specified limits.

For information concerning gas supply, the Petroleum Administration for Defense, Washington, D. C., may be contacted.

Annealing and Tempering

Tempering Machine for Bottles. Patent No. 2,561,529. Filed Aug. 10, 1942. Issued July 24, 1951. Seven sheets of drawings, none reproduced. Assigned to Emhart Manufacturing Company by C. E. Mongan, Jr., and Donald W. Mueller.

This machine includes a transfer which takes bottles as delivered by the forming machine and places them in an oven where they are brought up to the temperature necessary for tempering, tongs lifting the bottle to a point where blasts of air are discharged both on the inside and outside of the bottle. The tempered bottle is then placed on a conveyor for removal from the machine. Various adjustments and safety features are provided. The patent should be examined for a full understanding of the apparatus.

The patent contains 20 claims and 19 references were cited.

Bottle Tempering Machine. Patent No. 2,563,130. Filed Nov. 30, 1948. Issued Aug. 7, 1951. One sheet of drawings, none reproduced. Assigned to Emhart Manufacturing Company by George D. Mylchreest.

This machine includes a device to hold the bottle in neck down position and a nozzle with means to project it into the bottle. The nozzle is rotated and provided with a series of openings which discharge jets of air and water onto the inside of the hot bottle, these openings being arranged at certain angles so as to provide a better tempering than heretofore.

The patent contains four claims and the references cited were 1,396,092, Binns, Nov. 8, 1921; 1,701,066, Elkington, Feb. 5, 1929; 2,269,060, Mitford, Jan. 6, 1942; 2,375,944, Quentin, May 15, 1945; and 450,464, Great Britain, July 17, 1936.

Feeding and Forming

Pressing Method. Fig. 1. Patent No. 2,561,247. Filed Jan. 18, 1950. Issued July 17, 1951. One sheet of drawings. Albert J. Throm, Jeanette, Pa., inventor.

The figure shows a four-part mold and plunger and a plate 19. The plate supports preformed solid ornaments, 29 of which may be of glass or other material. When the glass is pressed in the mold, the ornaments will be imbedded therein as shown. The projecting stems of the ornaments are then removed.

The patent contains four claims and references cited were 249,676, Ripley, Nov. 15, 1881; 261,644, Vogeley, July 25, 1882; 359,682, Maxwell, Mar. 22, 1887; 490,905, Hanes, Jan. 31, 1893; 1,935,942, Conner, Nov. 21, 1933; 1,968,665, Warren, July 31, 1934; 2,073,254, Redman, Mar. 9, 1937; 2,353,995, Conner, July 18, 1944; and 2,451,913, Brice, Oct. 19, 1948.

Pressing Method. Patent No. 2,561,248. Filed Jan. 18, 1950. Issued July 17, 1951. One sheet of drawings, none reproduced. Albert J. Throm, inventor.

This invention is directed to the incorporation of ornaments in pressed glassware, the same as the preceding patent, but the second patent relates particularly to the provision of ornaments in the rim portions of cup-like ware such as bowls. The ornaments are supported by the mold parts during the pressing operation and the projecting parts are removed in the same manner.

The patent contains two claims and 10 references were cited.

Press. Patent No. 2,564,516. Filed (U. S.) Oct. 15, 1948. Issued Aug. 14, 1951. Two sheets of drawings, none reproduced. Invented by Václav Adam, Jablonec and Nisou, Czechoslovakia, assignor to "Ceskoslovenske zavody sklarske, narodni podnik," Prague, Czechoslovakia.

This is a high-speed press for making small articles, such as buttons. Two pairs of rollers cooperate so that dies formed on the peripheries press the articles between them. Adjusting mechanism is provided to keep the dies properly aligned and otherwise positioned. The glass to be pressed is probably in the form of rods which are softened by heat as they are fed downwardly.

The patent contains two claims and the only reference cited was 2,456,697, Gruenwald, Dec. 21, 1948.

Furnaces

Furnace Construction. Fig. 2. Patent No. 2,559,350. Filed Feb. 15, 1947. Issued July 3, 1951. Two sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by John L. Drake.

The figure shows a horizontal section through the checkers on one side of the tank. The usual checker work is here divided into two sections offset from each other so that they are accessible from all sides for the purpose of cleaning through hinged doors 22. The cleaning is done with a lance 37 inserted through the doors 22 and the dust may be removed through doors 38 and 39 at the bottom.

The patent contains two claims and the references cited were 1,322,208, Smythe, Nov. 18, 1919; 1,691,982, McGee, Nov. 20, 1928; 1,882,922, Schwalbe, Oct. 18, 1932; 1,911,495, Frank et al., May, 30, 1933; 2,179,848,

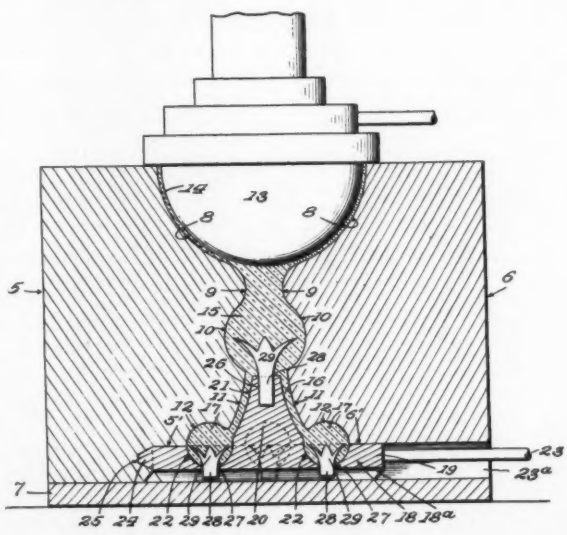


Fig. 1. Pressing Method.

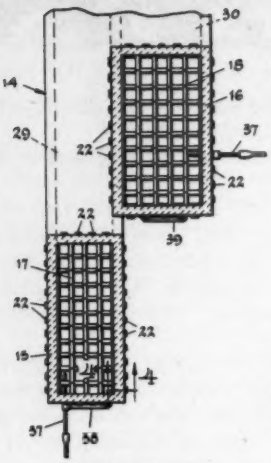


Fig. 2. Furnace Construction.

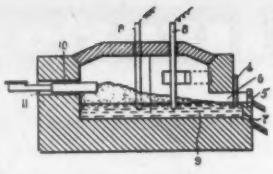


Fig. 3. Electric Enamel Furnace.

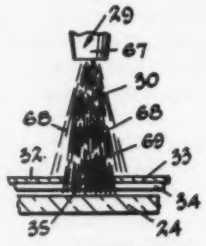


Fig. 4. Metallizing Glass Sheets.

Porter, Nov. 14, 1939; and 2,401,640, Hess, June 4, 1946.

Electric Enamel Furnace. Fig. 3. Patent No. 2,559,683. Filed March 15, 1949. Divided and this application filed May 4, 1949. Issued July 10, 1951. Four sheets of drawings. Assigned to Ferro Enamel Corporation by R. E. Skinner and G. H. McIntyre.

The figure shows a section of the furnace including an overflow spout 5 and a suspended bridge wall 4. Three electrodes 8 are connected to a three-phase 230-volt current. Batch is introduced by a feeder 10. Automatic controls are provided to regulate the current.

The patent discloses modified forms of the invention. It contains one claim and 18 references were cited.

Protecting Tank Walls. Patent No. 2,561,818. Filed Aug. 5, 1947. Issued July 24, 1951. One sheet of drawings, none reproduced. Assigned to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France by Ivan Peyches, Paris, France.

This is a method of preventing or reducing the erosion which takes place when glass is made in refractory tanks.

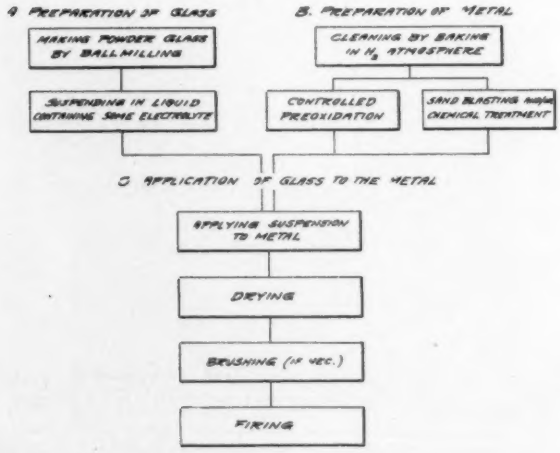

A PREPARATION OF GLASS
MAKING POWDER GLASS BY BALL MILLING
SUSPENDING IN LIQUID CONTAINING SOME ELECTROLYTE
B. PREPARATION OF METAL
CLEANING BY BAKING IN H_2 ATMOSPHERE
CONTROLLED PREOXIDATION
SAND BLASTING AND/OR CHEMICAL TREATMENT
C APPLICATION OF GLASS TO THE METAL
APPLYING SUSPENSION TO METAL
DRYING
BRUSHING (IF NEC.)
FIRING

Fig. 5. Glass-to-Metal Seal.

This method is useful whether the glass is melted by electricity or by fuel burners. The protecting method consists in the use of an electrically conducting tank wall and passing a direct current from the wall as an anode to a cathode immersed in the molten glass. This deposits a protective coating on the wall by an electro-chemical process.

The patent contains five claims and 11 references were cited.

Glass Compositions

Ultraviolet Transmitting Glass. Patent No. 2,561,325. Filed June 26, 1948. Issued July 24, 1951. No drawings. Assigned to Pittsburgh Plate Glass Company by J. E. Duncan.

A typical example of the batch of this invention with its calculated composition is:

Ingredient	Batch, Parts by Weight	Composition Per Cent	
Sand	1,000	SiO_2	66.26
Sodium carbonate	319	Na_2O	12.25
Potassium carbonate	113	K_2O	5.00
Calcium carbonate	200	CaO	7.38
Boric acid	150	B_2O_3	5.60
Zinc oxide	50	ZnO	3.31
Cadmium sulfide	3	CdS	.20

This batch produces a clear, substantially colorless glass which is readily fabricated into desired forms. The transmission of light rays of 290 millimicrons wavelength through 2 millimeters of this glass, is approximately 16%. It will transmit 39% of the light rays of 300 millimicrons wavelength.

The patent contains two claims and the only reference cited was No. 1,536,920 to Parkinson, dated May 5, 1925.

Glass for Bulbs, etc. Patent No. 2,562,292. Filed Oct. 26, 1949. Issued July 31, 1951. One sheet of drawings, none reproduced. Assigned to Owens-Illinois Glass Company by Harold R. Black and Lawrence V. Gagin.

This is a glass of low lead content, useful particularly in the electrical field, which is low in cost. The patent contains five claims, claim 1 being as follows: A glass composition comprising the heat-reacted product of the following component ingredients by weight in substantially the following proportions:

	Per cent
Silica (SiO_2)	67.9
Alumina (Al_2O_3) and iron oxide (Fe_2O_3)	1.0
Sodium oxide (Na_2O)	4.3
Potassium oxide (K_2O)	10.6
Barium oxide (BaO)	4.1
Lead oxide (PbO)	11.4
Arsenic oxide (As_2O_3)	0.1
Lithium oxide (Li_2O)	0.4

No references were cited by the Patent Office.

Porcelain Enamel. Patent No. 2,563,502. Filed Aug. 13, 1949. Issued Aug. 7, 1951. No drawings. Assigned to Ferro Enamel Corporation by B. J. Sweo.

One feature of this invention is the inclusion of fibers in the composition, these fibers being from 20 to 100 microns long and from 2 to 5 microns in diameter. These fibers may be of inorganic material, such as asbestos,

rock wool, glass wool, etc. The patent contains 16 claims, claim 15 being as follows: A porcelain enamel slip comprising 100 parts of frit, from 1% to 4% opacifier per 100 parts frit, from 0.25% to 0.75% electrolyte per 100 parts frit, from 32% to 55% water per 100 parts frit, from 0.5% to 2% bentonite per 100 parts frit, and from about 0.05% to about 50% of a non-metallic inorganic fibrous material consisting substantially entirely of fibers having a fiber diameter of from about 0.5 micron to about 15 microns and the length of said fibers being at least twice the length of the diameter of the minimum frit particle and not over 100 microns.

The references cited were 477,732, Abbott, June 28, 1892; 541,735, Frey, June 25, 1895; 1,842,970, Hovey, Jan. 26, 1932; 2,032,239, Wedlock, Feb. 25, 1936; 16,364, Germany, 1881; and 498,525 Great Britain, 1939.

Sheet and Plate Glass

Bending Mold. Patent No. 2,560,599. Filed June 30, 1945. Issued July 17, 1951. Two sheets of drawings, none reproduced. Assigned to Libbey-Owens-Ford Glass Company by Joseph D. Ryan.

A new mold is provided which can be used in either the horizontal or the vertical type of shaping flat glass sheets. Plaster of Paris molds such as shown in Patent No. 2,330,279 to Greaves-Walker have been used but the glass engaging surface does not last well. According to this invention, a plaster of Paris mold is covered with a plurality of layers of glass cloth, such as the Owens-Corning Fiberglas Corporation product "ECC-11-116". The surface is then treated with a resin such as "Dow Corning No. 2101". In some cases the glass engaging surface thus prepared may be formed on a shaping form. This mold is recommended particularly for the male member. This produces a long lasting mold which gives a high grade surface to the glass.

The patent contains three claims and 11 references were cited.

Miscellaneous Processes

Metallizing Glass Sheets. Fig. 4. Patent No. 2,559,351. Filed Dec. 5, 1947. Issued July 3, 1951. Three sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by John L. Drake and John P. Pearse.

This patent shows a method and machine for metallizing the edges of glass sheets so that they may be bonded to separators to form multiple glazing units. It is an improvement upon what is shown in Patent No. 2,283,253 to Haven. It has been usual to apply copper or a copper alloy to the glass by means of a spray gun but it is found that when such a gun is used at an angle of other than 90 degrees to the sheet, the outside of the spray is cooler than the inside and poor distribution and poor adhesion result.

These inventors have found that better results are obtained if the spray is directed onto the glass at an angle of 90 degrees and if only the hotter inside of the spray is allowed to hit the glass. They provide a machine having moving belts 32, 33, and 34 which cut off the outside of the spray from the gun 29 and allows only the interior of the spray to hit the glass and this at 90 degrees to the surface of the glass. A modified form of the invention is disclosed and the complete machine is described.

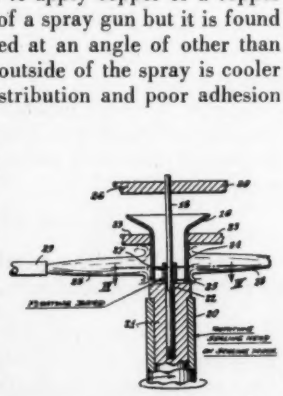


Fig. 6. Glass-to-Metal Seal.

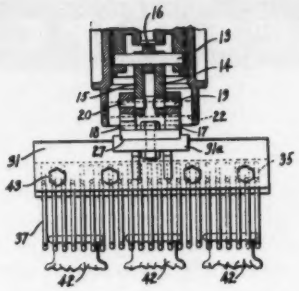


Fig. 7. Stacker Tongs.

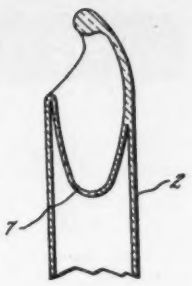


Fig. 8. Tipping-off Method for Exhaust Tubes.

The patent contains 17 claims and the references cited were 1,221,695, Dann, Apr. 3, 1917; 1,256,599, Schoop, Feb. 19, 1918; 2,334,624, Haven et al., Nov. 16, 1943; 2,432,659, Criswell, Dec. 16, 1947; and 530,198, Germany, July 23, 1931.

Glass-to-Metal Seal. Fig. 5. Patent No. 2,560,593. Filed May 4, 1945. Issued July 17, 1951. One sheet of drawings. Assigned to Westinghouse Electric Corporation by J. A. Pask and J. E. Schiveree.

This invention is directed particularly to making tight seals between glass and a nickel-cobalt-iron alloy such as "Kovar". The figure is a flow diagram which practically discloses the invention except for details which can be obtained from the patent.

The patent contains two method claims and 14 references were cited by the Patent Office.

Glass-to-Metal Seal. Fig. 6. Patent No. 2,561,061. Filed Dec. 17, 1947. Issued July 17, 1951. One sheet of drawings. Assigned to Westinghouse Electric Corporation by J. B. Leuzarder, J. J. Aakjer, and W. J. Knochel.

This is a seal for lead-in wires or posts through glass enclosures, such as lamps, etc. The drawing shows a tube know as a Rectigon in which a flare 16 carries a lead-in wire or post 18 mounted in a head 20. The flare is carried by a support 23 which rotates with the head 20. The upper part of the post is supported by rotating fingers 26. A floating bead 27 rotates with the post 18. Flames from burners 29 seal the parts to the post which has been coated with oxide.

The patent contains six claims and the references cited were 1,692,998, Ruben, Nov. 27, 1928; 2,010,145, Eitel, Aug. 6, 1935; 2,220,742, Thorson, Nov. 5, 1940; 194,673, Great Britain, Nov. 8, 1923; and "Procedures in Experimental Physics," (pg. 24), by John Strong et al., pub. by Prentice-Hall, Inc., N. Y., 1944.

Stacker Tongs. Fig. 7. Patent No. 2,561,536. Filed Oct. 24, 1946. Issued July 24, 1951. One sheet of drawings. Assigned to Emhart Manufacturing Company by George E. Rowe.

These tongs are for picking up a row of bottles or other ware where there may be slight variation in the diameter of the finish and where the ware may be slightly out of line. They are adapted for use on the Hartford-Empire stacker as shown in Patent No. 1,878,156 to

(*Continued on page* 482)

Practical Aspects of the Electric Melting of Glass

In the October 1950 issue of the *Journal of the Society of Glass Technology*, E. V. Borel discusses some of the practical aspects of the electric melting of glass, the method of melting being that which utilizes the Joule effect in the mass of molten glass.

Molten glass is an electrolytic conductor of electricity. This being so, it is apparent that glass may be used as a heating resistance provided alternating current is employed so that the effects of electrolysis are avoided. If one has available alternating current of the frequency normally applied to the industry, say 40-60 cycles per second, electric energy may be used in this form. If, however, alternating current is not available and it is necessary to install a special generator, it is preferable to arrange for a higher frequency. In every application of electricity for heating glass, it is necessary to know the resistivity of glass as a function of temperature.

Many industrial glasses contain between 10 and 20 per cent of soda or potash or a combination of both. As it is fairly difficult to determine the resistivity of glass at high temperatures, a method has been developed which allows this property to be determined rapidly and with sufficient accuracy for practical purposes. In this method, the resistivity curve of a glass of known composition, especially with respect to its soda and potash content, is determined as precisely as possible in the laboratory. The resistivity (pm) of a soda-lime-silica glass containing m% Na_2O can (for values between 10 and 20%) be derived from that of known alkali content (n% Na_2O) and known resistivity (pn) by the means of a simple formula:

$$pm\% = pn\% \times \frac{n}{m}$$

when potash as well as soda is present, the equivalent percentage of Na_2O for use in the formula is $m\% = \left(Na_2O + \frac{K_2O}{2}\right)\%$,

since the potassium ion has approximately twice the volume of that of the sodium.

The amount of current which passes through glass rises progressively with rise of temperature producing an effect known as self-deregulating. This effect increases with the steepness of the resistivity-temperature curve and the margin for regulation of the current has to be progressively wider the steeper the curve. The conditions for melting glass entirely by electricity are favorable in the case of commercial soda-lime-silica glasses for which the tangent to the resistivity curve is small (70°20′ at 1450°C. for the glass SiO_2 71.6, CaO+MgO 12.7, Na_2O 15%). For silicate of soda with a still smaller tangent, the current regulation during melting is easy. On the other hand, the curves for borosilicate and lead glasses are much steeper. Experience has suggested that glasses for which the angle is at least 2.5 times that of the 15% soda-lime-silica glass should preferably be melted by a combination of fuel and electric heating.

By choosing the position in the bath and the diameter of the electrodes, the distribution of the temperature in the glass can be controlled and oxidation of the electrodes (particularly those of graphite) can be prevented. Flame heating and submerged electrode heating produce different temperature gradients in the glass. In the former, the heat energy is transmitted partly by contact with the flame and partly by radiation to the glass surface and from there to the deeper layers. The surface is therefore the hottest part and it is in this region where furnace refractories are most attacked. Direct electric heating produces a quite different temperature directly into heat energy in the mass of the glass, while the surface of the bath radiates to the crown (the reverse of a flame-heated furnace), the result being that the maximum temperature is reached at a certain distance below the glass surface.

To make calculations for a furnace, it is first necessary to determine the necessary energy or, in other words, a thermal balance. The furnace having been designed, the heat losses from its several parts should be determined. They depend mainly on the thermal conductivity of the refractories used, on insulation, or on the necessity for cooling. Table I gives the mean values for heat losses from furnace walls. The losses having been calculated, the minimum power required may be deducted directly for a furnace having zero tonnage output. As heat losses increase with the age of a furnace, it is necessary to make a correction of about 20 per cent. It is then sufficient to add the necessary energy for melting and heating the glass in order to obtain the energy input into the furnace.

For a glass containing 15 per cent Na_2O, the necessary energy per kg. of glass is:

Energy for glass melting = about 175 k.cal.
Energy carried away in the gases from dry raw materials = about 65 k.cal.
Energy carried away by steam from the raw materials = about 30 k.cal.
Energy in the glass drawn at 1100°C. = about 320 k.cal.
Total: about 590 k.cal.

590 k.cal. = 0.686 kwh.

The value may be taken as 0.700 kwh. per kg. of melted glass.

In order to remelt cullet, it is necessary only to calculate on the basis of the energy absorbed by the glass. If the glass is raised to a temperature of 1100°C., the result is about:

320 k.cal. or 0.372 kwh.

If the final glass is melted from 70 per cent raw materials and 30 per cent cullet, the total energy absorbed is:

0.6 kwh. per kg. of glass.

An electric glass melting furnace is a high-performance unit. Its use demands a qualified staff and, above all, a competent technical service in order to obtain

products of high quality. If these conditions are not fulfilled, it is preferable either to retain ordinary combustion furnaces or to adopt "mixed melting", control of the furnace then being obtained through the combustion operation so that the general routine of the personnel remains unchanged.

Electric melting has opened up possibilities of other techniques, one of which is "deferred melting". "Deferred melting" is almost a revolution in glassmaking. In effect, it consists in separating the operations of melting and refining. Melting can take place at a relatively low temperature and the unrefined glass delivered to a refining cell where electric heating is applied within the body of the glass, the electrodes being disposed to produce important convection currents, thereby adding to the heating process an intense mixing which gives glass of excellent homogeneity.

Although refining cells are relatively small, for example, 1.7m. long by lm. wide, their refining capacity is exceedingly large. A cell of these dimensions can refine more than 24 tons per 24 hours, using a quite small power input of about 180 kw. Even a casual examination of these figures demonstrates that this method is economical. Further, electric refining cells allow the manufacture of colored glass owing to the intense mixing obtained due to strong convection currents. The coloring agents are added directly to the glass in the refining cell and, in spite of the high output, the glass arrives at the machines with a homogenous color. In this manner, a large furnace equipped with two "coloring-refining" cells can supply from a basic, nearly colorless, glass, both colorless and colored glass at one time. A color change can be achieved in a few hours because the cell contains very little glass in proportion to its output.

TABLE I

LOSSES THROUGH THE FURNACE WALLS OF GLASS FURNACES

Materials	Wall or Crown Thickness (mm)	Thickness and Type of Insulation	Temp. °C.	Losses per sq. mm. per hr. Kwh.	K.cal.
Corhart	200		1,450	13.0	11,120
"	300		1,450	10.0	8,600
"	300		1,400	9.5	8,170
"	300	Free Convection	1,300	9.0	7,740
"	300		1,200	8.2	7,050
"	300		1,100	7.3	6,280
"	300	60 mm. Sup., 60 mm. C22	1,300	2.3	1,970
"	300	120 mm. Sup., 120 mm. C22	1,300	1.7	1,460
"	300	60 mm. C22, 60 mm. Nat.	1,200	1.7	1,460
Corhart (bottom)	150	150 mm. Silico-Al	1,400	6.7	5,750
" "	150	300 mm. Silico-Al	1,400	4.4	3,800
" "	150	180 mm. Silico-Al, 120 mm. Sup.	1,300	1.9	1,640
" "	150	180 mm. Silico-Al, 120 mm. C22	1,200	1.75	1,500
" "	150	180 mm. Silico-Al, 120 mm. sand.	1,300	2.0	1,720
Silico-Aluminous	300		1,400	5.3	4,600
" "	300		1,300	4.9	4,200
" "	300	Free Convection	1,200	4.35	3,850
" "	300		1,100	4.1	3,500
" "	300	60 mm. Sup. 60 mm. C22	1,300	1.75	1,500
" "	300	120 mm. C22	1,300	1.6	1,380
" "	300	60 mm. C22, 60 mm. Nat.	1,100	1.0	860
Silica (crown)	300	Free Convection	1,450	6.0	5,200
" "	300		1,400	5.8	5,000
" "	300	60 mm. Sup., 60 mm. C22	1,400	2.0	1,720
" "	300	120 mm. Sup., 60 mm. C22	1,400	1.5	1,300
" "	300	120 mm. Sup., 60 mm. C22, 60 mm. Nat.	1,400	0.95	830
" "	300	60 mm. Sup., 120 mm. C22, 60 mm. Nat.	1,300	0.88	760
" "	300	120 mm. C22, 120 mm. Nat.	1,200	0.7	585

For cooled walls, increase the loss by 20-35 per cent.

Abbreviations: Sup. = super-silocel brick or equivalent bricks.
C22 = C22 silocel brick or equivalent bricks.
Nat. = Natural silocel brick or equivalent bricks.

CHAPEL OF GLASS

Wayfarers' Chapel is the latest architectural challenge of the ecclesiastic past by Architect Lloyd Wright, son of the famed Frank Lloyd Wright. Mr. Wright reasoned that "traditional church buildings too often are caverns, barring worshippers from the outside world's natural beauty. My conception is that in this modern age of glass, we can turn outward to the beauty of the world, to the tree groves which were Man's first chapels."

Landscaping will emphasize such groves with pine trees and redwoods located on nearby hillsides. A cloistered garden with plants like those in the Holy Land, and inside the church vines will reach to the roof from stone boxes. This new and unusual shrine, except for its framework of redwood beams and low sidewalls of native stone, is a vast expanse of plate glass designed to let the outdoors in.

Situated atop a knoll above the coastal road near Portuguese Bend, Palos Verdes, California, it has a breath-taking view of the Pacific coastline. The inspiration for this unusual chapel was an 18-year-old dream of Mrs. Elizabeth S. Schellenberg of Palos Verdes Estates. It stands as a memorial to Emanuel Swedenborg, 18th century scientist and theologian and has the rallied backing of hundreds of Southlanders of kindred faith who have added their backing to its realization. One of the largest donations is its 3½ acre site, the gift of Mrs. Frank A. Vanderlip, widow of the late president of the National City Bank.

The church itself is just a part of the contemplated chapel, with tower, cloister, and reception hall yet to be built. Organized as a nonprofit religious institution, its doors are open to all who wish to attend.

MEETING HELD ON SELENIUM SITUATION

The Glass Container Manufacturers Industry Advisory Committee, meeting with the National Production Authority, recommended adoption of conservation measures in all industries using selenium to bring supply and demand in balance.

NPA explained that a critical shortage of selenium now exists because the limited quantity produced is used not only by glass manufacturers, but also by the producers of stainless steels, rubber, chemicals, ceramics, and certain electronic and electric power equipment.

NPA told the committee that the current copper situation has made future production of selenium uncertain. The estimated 1951 production will be approximately one million pounds, but demands now exceed the available supply by nearly 50 per cent, NPA said. The committee heard a group of technical experts report on the importance of selenium to the glass container industry's production. The experts recommended that a conservation measure might reduce the use of selenium by approximately 30 per cent by lowering the quantity used in glass manufacture. The committee agreed that the industry as a whole would be willing to operate under such a conservation order if it were certain of getting whatever selenium was finally allocated to it.

Herman B. Esselen, of NPA's Containers and Packaging Division, presided. Committee members attending included S. B. DeMerrell, Anchor Hocking Glass Corporation; Roger Hertzel, Armstrong Cork Company; E. F. Ball, Ball Brothers Company; C. R. Avery, Chattanooga Glass Company; J. M. Foster, Foster-Forbes Glass Company; J. S. Algeo, Hazel-Atlas Glass Company; H. S. Wade, Owens-Illinois Glass Company; and F. B. Pollock, Thatcher Glass Mfg. Company.

R. H. BARNARD ANNOUNCES PRODUCTION OF FINEST GLASS FIBER

Production of the finest glass fibers ever made by man has been announced by R. H. Barnard, President of Glass Fibers, Inc. Diameters of the fibers produced by the Ohio firm are less than the shortest wavelength of visible light. They are three times finer than any glass fibers previously manufactured on a commercial basis. A single pound of the fibers, laid end-to-end, would extend more than ten million miles, according to Mr. Barnard's statement.

Indicated uses for this new material are myriad. From it a glass paper has been manufactured on a Fourdrinier paper-making machine. Such a glass paper opens up an entirely new field in the filtering of sub-micron dust and particles. Its efficiency in filtering particles as small as one ten-millionth of an inch is revolutionary, Mr. Barnard further states. Tests have proven that the new glass paper filters out all but one particle from one hundred thousand particles.

Mr. Barnard went on to say that designers of power-type capacitors and condensers for electronic equipment and television and radio receivers will find new uses for this glass material. Capacitors and condensers made with thin glass paper will have lower electrical losses, greater high temperature stability, and greater capacity per unit of weight and size than those made with present-day materials.

GENERAL REFRACTORIES OPENS NEW WAREHOUSE

Opening of the newly constructed Chicago sales warehouse of the General Refractories Company has been announced by Drew M. Thorpe, Vice President.

The warehouse, which contains 10,000 square feet of storage space, incorporates latest materials handling features and contains heated storage spaces for wet cements and mortars.

Roger W. Braden has been appointed Manager of the warehouse, which will house a complete line of clay, silica, basic and sillimanite brick, specialties, and industrial insulations and related products.

Current Statistical Position of Glass

Employment and payrolls: Glass industry employment during June 1951 dropped a little more than 1 per cent from the 131,100 persons employed during May to 129,500. During June 1950, employment had been 118,200, or close to 10 per cent below this year.

Payrolls during June 1951, however, because of higher average weekly earnings, rose to a preliminary $40,952,825. Compared with May payrolls of $37,318,489, an increase of close to 10 per cent is shown. Payrolls during June 1950 were $30,660,192—or about 33 per cent less than for June this year.

Glass container production, based on figures released by the Bureau of Census, were reported at 10,354,762 gross during July 1951. Compared with the previous month's production of 10,489,467 gross, this represents a drop of a little more than 1 per cent. During July 1950 production of glass containers was 8,870,262 gross, or about 16½ per cent below July this year. At the close of the first seven months of 1951, glass container production has reached a total of 73,234,847 gross. This figure is 23½ per cent ahead of the same period last year when production was 59,273,906 gross.

Glass container shipments during July fell somewhat to reach 9,686,865 gross. This is a 4½ per cent drop from June shipments of 10,148,644 gross, but is 4 per cent ahead of the 9,305,566 gross shipped during July 1950. During the January-July 1951 period, a total of 69,400,340 gross were shipped. Compared with the 58,974,027 gross shipped during the corresponding period in 1950, a difference of a little more than 17½ per cent is represented.

Stocks on hand at the close of July were 10,375,274 gross, which is about 6 per cent more than the 9,714,037 gross on hand at the close of June. Stocks at the end of July 1950 were 8,931,128 gross.

Automatic tumbler production during July 1951 was 5,560,327 dozens. This is close to 13 per cent below the previous month's production of 6,383,874 dozens. During July 1950 production was 5,208,817 dozens. Shipments fell off only slightly from the 5,736,905 dozens during June to reach 5,733,180 dozens for July. During July 1950 shipments were 5,264,096 dozens. Stocks on hand at the close of July 1951 were 11,768,503 dozens, or a little more than 1½ per cent less than 11,973,689 dozens on hand at the close of June. Stocks for July 1950 were 8,667,162 dozens.

Table, kitchen, and household glassware: Manufacturers' sales of machine-made table, kitchen, and household glassware during July 1951 rose a little more than 3 per cent to reach 2,766,096 dozens. During June sales had been 2,682,232 dozens. Sales during July 1950 were 2,529,909 dozens. Total manufacturers' sales at the close of the 12-month period ending July 1951 were 40,727,881 dozens, or about 5½ per cent more than the 38,766,382 dozens sold during the same period in 1950.

GLASS CONTAINER SHIPMENTS
(All figures in Gross)

Narrow Neck Containers

	July 1951
Foods	738,371
Medicinal & Health Supplies	957,202
Chemicals, Household & Industrial	602,991
Beverages, Returnable	838,111
Beverages, Non-returnable	19,567
Beer, Returnable	535,690
Beer, Non-returnable	1,312,538
Liquors	546,691
Wines	199,457
Toiletries & Cosmetics	474,806
Sub-total (Narrow)	6,225,424

Wide Mouth Containers

Foods	*2,326,366
Dairy Products	266,225
Medicinal & Health Supplies	264,750
Chemicals, Household & Industrial	92,414
Toiletries & Cosmetics	128,020
Packers' Tumblers	89,240
Sub-total (Wide)	3,167,015
Total Domestic	9,392,439
Export Shipments	294,426
TOTAL SHIPMENTS	9,686,865

* This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All figures in Gross)

		Production July 1951	Stocks July 1951
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,308,373	3,908,287
	Wide Mouth	*2,909,343	*3,935,784
Dairy Products		298,378	313,604
Beverages, Returnable		868,167	559,064
Beverages, Non-returnable		22,319	26,261
Beer, Returnable		630,584	248,039
Beer, Non-returnable		1,417,790	264,845
Liquors		571,286	633,950
Wines		225,858	344,591
Packers' Tumblers		102,664	140,849
TOTAL		10,354,762	10,375,274

* This figure includes Home Canning.

L-O-F FIBER GLASS DIVISION STAFF ADDITIONS

The appointment of B. I. Wixey as Foreman of the new Fiber Glass Division factory of Libbey-Owens-Ford Glass Company at Parkersburg has been announced. Mr. Wixey, who joined the company in 1941, had recently been labor foreman in the Thermopane factory at Rossford which was opened in 1946.

Fred W. Segerstrom, district manager of industrial sales at the L-O-F Los Angeles plant, has been transferred to the new Fiber Glass Division as manager of super fine fiber glass sales. Mr. Segerstrom joined L-O-F in 1939 as sales representative in Seattle.

Construction work on the first factory unit of the new Division is being rushed so that production may get under way late this year.

New Equipment and Supplies

ELECTRIC HEAT TREATING FURNACE

Gilbert S. Simonski Company, 401 North Broad Street, Philadelphia 8, Pa., is manufacturing Series 7055 and 7056V Lucifer Electric Heat Treating Furnaces.

The Series 7055 model boasts a size that is twice as long as high leading to uniform heat distribution and low cost of operation. It is sturdily built on an all-electric welded angle iron frame of ample section. Temperatures are usable to 2000° F. The Model H-7055 is similar in every respect but goes to 2300° F. The refractory is of the highest quality and is a minimum of 5" thick and there are four different types of refractory used.

Series 7056V was designed to fill a specific need in those industries where it is necessary to heat treat relatively long slender pieces with the minimum of warpage. The pieces can be suspended from the top by one end, and allowed to hang in a vertical position causing minimum distortion since the weight tends to keep it straight. These furnaces are available in two heat ranges: 2000°F. and 2300°F.

BAUSCH & LOMB LABORATORY MICROSCOPES

Bausch & Lomb Optical Company, Rochester, New York, now has in production a new line of laboratory microscopes utilizing ball bearings and rollers throughout the focusing system. The new instruments, designated Dynoptic Labroscopes, also feature a low position fine adjustment and a mechanical stage with low controls that enable the operator, after setting the coarse adjustment, to rest his hand on the table and manipulate the other controls in a comfortable position.

A ball bearing on the horizontal shaft of the low position fine adjustment absorbs thrust as well and assures effortless turning of the focusing knob. Two rollers on the lever transfer horizontal movement of the screw to vertical travel of the focusing slide. The slide is fitted with ball bearings assembled in pressure plates. Finally, the nose-piece has ball bearings around its outer rim and a ball stop, a combination which assures parcentricity over a long period of effortless use.

DECORATING MASKS

Jas. H. Matthews & Company, 3984 Forbes Street, Pittsburgh 13, Pa., has announced the manufacture of masks for decorating and identifying products requiring simple or elaborate color schemes.

The Matthews spray mask is a shell-like mold which fits snugly over an object to be colored. The surface of the object to remain protected is covered by the mask, while cavities in the mask permit color to be applied on the desired parts.

To permit each insertion of a product into the mask, backing-out, or the building up of any portion of the mask in the electrocasting process, may be used. Backing-out is also necessary in multicolor spraying so the contact surface of the mask will not touch "wet paint" areas.

By treating a spray mask with special cold-setting rubber, beautiful frosted effects can be obtained with sand blast marking. The rubber protects the metal mask against abrasive wear during the blasting operation. Various depths of tone can be accomplished by sand blasting one pattern over another.

LABORATORY GLASSWARE WASHER

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced a new Fisher laboratory glassware washer which takes six large basketsfull of ware at once—bottles funnels, culture tubes, flasks, pipettes, Petri dishes, microscopic slides—delivers them thoroughly washed and rinsed, chemically clean, in a fraction of the time required by conventional "dishwashing".

Designed by Fisher Development Laboratories after a survey of glassware problems in both service and industrial organizations, the first model was rigorously field-tested. The operator merely loads the proper size of basket, attaches the lid, places basket on the drum. The drum carries the baskets Ferris-wheel fashion into the washing solution and out again to drain. Numerous small jets are located at one end of the tank, which admit hot, cold, and warm water. Glassware can thus be given hot and cold rinses as desired and, in the steam-heated model, can be treated with live steam as well. All operation controls are on a simple panel in easy reach of the operator.

CATALOGS RECEIVED

Research Vacuum Supply Company, 3434 West Montrose Avenue, Chicago 18, Illinois, has issued a new 40-page, illustrated catalog listing research high vacuum equipment, high vacuum pumps and oils, gauges, and glassworking machinery.

Catalog 11K also includes information on a full line of hand fires, torches, blast burners, needlepoint burners and accessories, cross-fires, and miscellaneous supplies for glass blowing.

Harbison-Walker Refractories Company, 1800 Farmers Bank Building, Pittsburgh 22, Pa., has published a 4-page bulletin describing Vega Bond, a superduty silica cement for use in laying Vega, Star, and other silica refractories.

This heat-setting cement corresponds in refractoriness and in chemical and physical properties with the best silica brick and is recommended for poured or trammeled joints. Vega Bond does not soften in service, even at a temperature as high as 3000° F.

In addition to descriptive material, the bulletin includes a series of photographs which show the results of comparison tests between Vega Bond and other silica cements. Among the properties illustrated are comparative effects of heat treatment, refractoriness, trowelling, and settling.

The Erskine Glass & Manufacturing Company, Wellsburg, W. Va., has published a catalog of illuminating glassware for lamps and lighting fixtures.

Illustrating a variety of decorative treatments for each type of product, the catalog is recommended by the manufacturer for use in selecting original components and replacement illuminating glassware. Included are photographs and details on Baroque Hi-Lites, Crystal Lux glassware for kitchens and bathrooms, globes and lanterns of many kinds, and parts such as cylindrical columns, bases, breaks, and fonts for lamp assembly.

Toledo Engineering Company, 958 Wall Street, Toledo, Ohio, is distributing a four-page pamphlet devoted to its Bottle Tester.

The folder illustrates the Tester, together with a brief outline of the advantages and specific parts of the equipment.

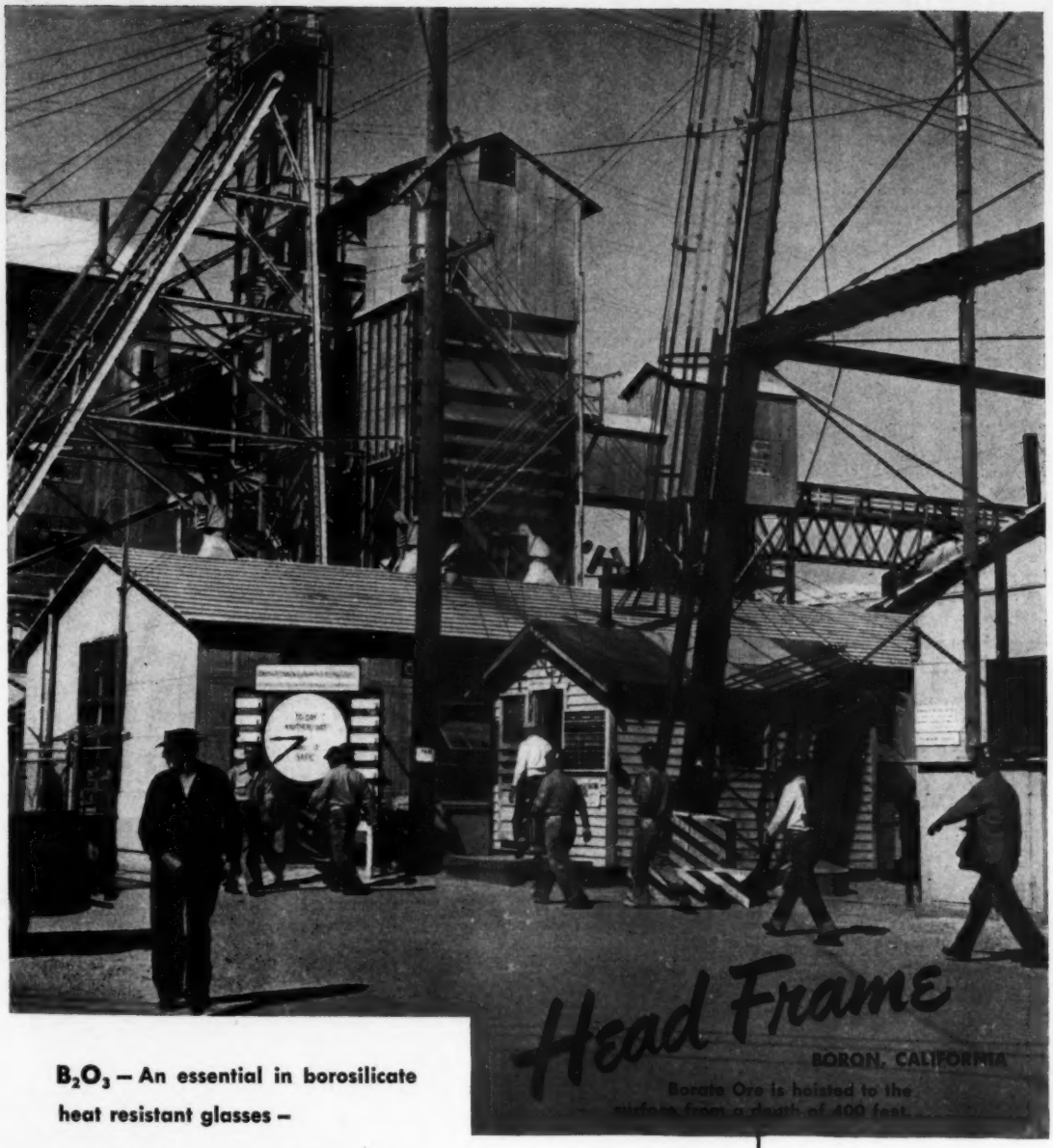
The Jeffrey Manufacturing Company, Columbus 16, Ohio, has issued its Catalog 830 which is devoted to its Jeffrey-Traylor electric vibrating feeders and conveyors.

The booklet is filled with illustrations and detailed data of the company's varied line of equipment. Photographs, line drawings, and specification tables all contribute to presenting a complete picture of the feeders and conveyors manufactured. An index in the book is supplied for quick reference.

Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa., has announced its Booklet B-4696 which presents information on "how to select" electrical measuring instruments.

In this 30-page instrument booklet, seven basic selection factors are explained, types of instruments available in each major classification are listed on a full-page check chart, and four typical selection problems are solved to help the reader make his selection.

Complete lines of portable, switchboard, panel, recording, and socket instruments are described and illustrated, and functions of each are explained. Descriptions of instrument auxiliaries are included.



B_2O_3 — An essential in borosilicate heat resistant glasses —

In lesser quantities in container ware batches, will give improved melting, a more easily fined glass, improved appearance and DURABILITY in finished ware.

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GLASS LIBRARIANS TO MEET AT CORNING GLASS CENTER

On September 28 and 29, librarians whose primary interests are glass and allied ceramic fields will meet at the new Corning Glass Center. On the second day of the meeting, September 29, joint meetings will be held with

Mrs. Catherine Mack

James M. Brown

the Western New York Chapter of the Special Libraries Association, as that group opens its activities for the 1951-52 season.

The program for the two-day session includes talks by James M. Brown, Director of the Corning Glass Center, Howard R. Lillie, President of the American Ceramic Society, E. P. H. James, Director of Centennial Public Relations for Corning Glass Works, and H. G. Vogt, a research physicist on Corning's staff who has specialized in demonstrative lectures. Discussions will be led by Chester G. Salmon, Librarian of Bausch & Lomb Optical Company.

Special tours of the Glass Center will be a feature of the meeting, and a visit to Corning Glass Works' Technical Library in the main plant has also been arranged. Hostess to the conferees will be Mrs. Catherine Mack, Corning's Librarian. Mrs. Mack organized the program for the meeting with the assistance of Miss Emily Van Schoick, Librarian of the New York State College of Ceramics, and Miss Betty Bowerman, Librarian of Armstrong Cork Company, as well as with President J. Gormly Miller of the Western New York Chapter of the Special Librarians Association.

JOHN FISHER OF BALL BROTHERS IN NEW POST

John W. Fisher, Ball Brothers' Vice President and a manufacturing executive for the last 10 years, has been named to the only dual post in the company's management, that of Vice President in charge of the Ball metal closure and zinc rolling mill operations.

Mr. Fisher's appointment was announced by Edmund F. Ball, President of the firm. It was the fifth major change the company has made since the first of the year to decentralize operations and provide a management in sufficient depth to meet demands upon a business that had outgrown older organizational lines.

Mr. Ball said that Mr. Fisher will be responsible for all operations of both the Metal Closure and the Zinc Rolling Mill Divisions and will report to the chief operating officer of the company, Duncan C. Menzies, Executive Vice President and General Manager.

BROCKWAY OPENS PLANT AT LAPEL, INDIANA

Brockway Glass Company has announced the opening of its fourth plant, located at Lapel, Indiana. Glass containers for food products, liquor, proprietary and pharmaceutical medicines will be manufactured in the new plant. Production will include the operation of three machines before September 1, with the remainder of five in full operation not later than October 1.

G. A. Mengle, President of the company, has announced Ray Schlehr as Manager of the new Lapel plant. Paul Hubbard will be Mr. Schlehr's assistant; W. E. Frick, Office Manager; Robert Warfield, Jr., will handle traffic, purchases, and plant scheduling; and Harry White is superintendent of the packing room.

UNUSUAL ENTRY IN GLASS HOBBY CONTEST

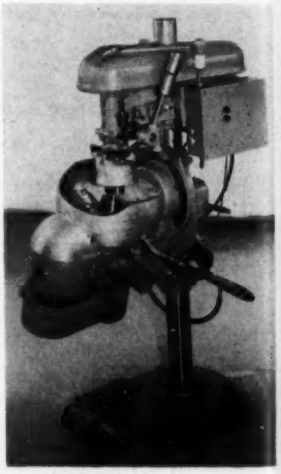
Hundreds of interesting entries have been received by the Glass Bottle Blowers Association (AFL) in their Glass Hobby contents, but one they received recently had them puzzled.

Rev. Jewel Pierce, of Piedmont, Alabama, evangelist who calls himself a "Bottle and Water Preacher", writes that he spreads the gospel with old bottles. In his letter to Glass Hobby Contest officials, he writes, "I gather bottles from back alleys, garbage cans, and anywhere they can be found, clean them, enclose printed religious tracts, seal with cork, and cast them into streams and rivers."

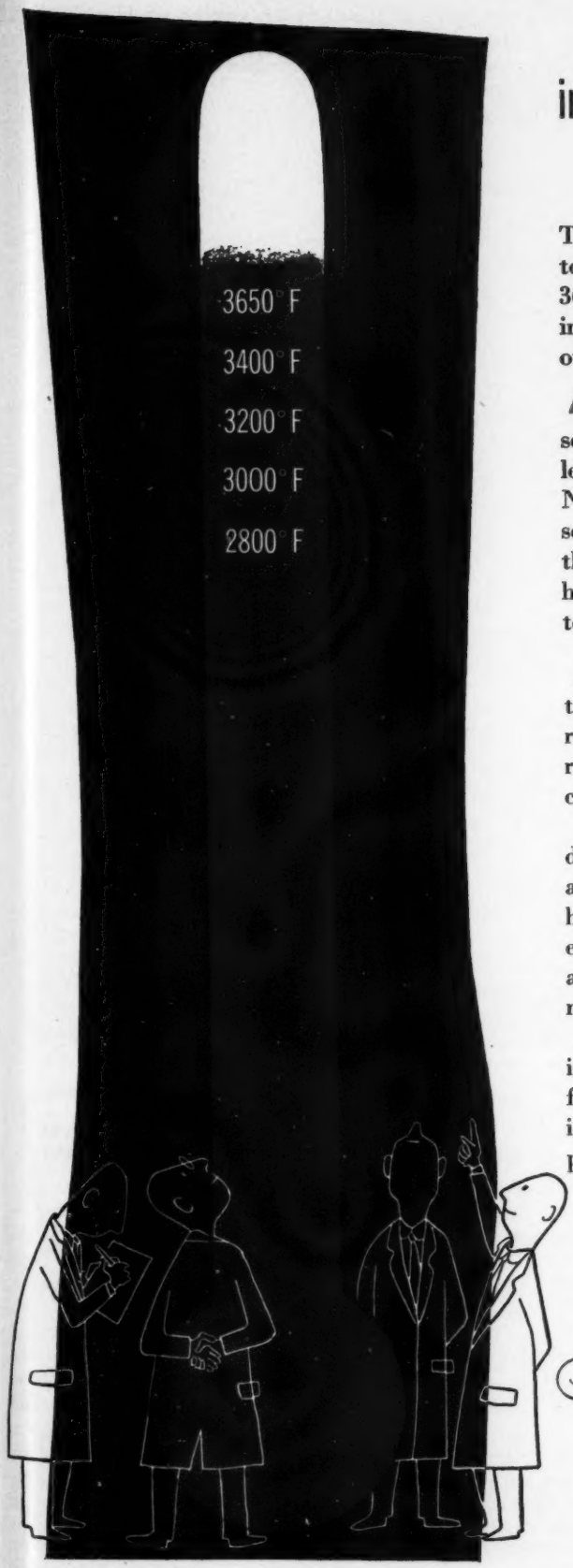
According to Rev. Pierce, his floating sermons have reached people in 23 states and 6 foreign countries. Each bottle contains a signed note from the Reverend urging the finder to write him when and where the bottle was found and offering a gift.

DRILL PRESS TURNED DIAMOND MILLING MACHINE ADAPTABLE FOR MAGNIFIERS, TUBES, OPTICS, AND INSTRUMENT PARTS

Using standard 17 in. Delta drill presses as the basic units, Shuron Optical Company, Inc., Geneva, N. Y. engineers developed special lens generators or diamond milling machines to generate spherical curves on both the convex and concave sides of spherical lenses, the convex side of toric lenses, and the concave side of sphere bifocals.



The company also uses the machines for generating both convex and concave sides of round and pear-shaped sun-glass lenses. A normal day's run for one operator is 1,600 to 2,000 lenses ground on both sides. The Shuron firm finds that their specially-adapted Delta machine is readily usable for diamond milling of magnifiers, small test plates, television projector tubes, and precision optics.



Teamwork in Pioneering Refractories for Higher Temperatures

The trend in industry is to higher and higher temperatures. In the range of 2800° F. to 3650° F., high-alumina refractories are meeting a wide range of service conditions at low over-all cost.

NORTON... Industry is constantly seeking the answers to high-temperature problems. To meet these temperature ranges, the Norton Company of Worcester, Massachusetts, is producing a line of super-refractories that will stand the gaff. For 36 years, Norton has been pioneering in the field of higher temperatures.

ALCOA... From Alcoa plants come the aluminas that team with Norton and other refractory manufacturers to produce the super-refractories that economically meet these increasing service demands.

ALCOA, too, has pioneered in this field, developing aluminas that give refractory brick and special shapes: Additional strength at high temperatures . . . lower coefficient of expansion . . . higher resistance to spalling and cracking . . . chemical inertness . . . negligible porosity and shrinkage.

ALCOA pioneering will always go forward in partnership with America's leading manufacturers of refractories . . . seeking the answers in terms of aluminas for tomorrow's refractory products. We'd like to help you with your high-temperature problems. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 613-J Gulf Building, Pittsburgh 19, Pennsylvania.

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

GLASS COMPOSITIONS . . .

(*Continued from page* 453)

made on the samples of glass used for chemical analyses. The averages of the measurements are shown in Table III.

The distribution of the various properties and their association with chemical composition and the manufacturing process are discussed in the following sections.

(a) *Softness Temperature.* The distribution chart for the softness temperatures, Figure 10, shows that the most common group is 710° C. Approximately the same number of glasses are above and below the most common group. The wide range in softness temperatures, from 692° to 736° C., are an indication of the variation in the chemical composition, especially in the percentages of alkali and lime.

The increase in the percentage of glasses having a softness temperature above 720° C. shows the general trend toward faster setting glasses.

(b) *Annealing Point.* The average annealing point is 528° C. and lies within the most common grouping of 530° C., Figure 11. The annealing points of the many container glasses fall into two evenly divided groups, those above 530° C. and below 525° C. This is due to the effect of lime and to a combination of lime plus magnesia on the annealing point. Calcite glasses have a relatively high annealing point in comparison with a glass having the same total lime plus magnesia.

All the glasses that have relatively high annealing points, 540 to 555°C., are made with calcite lime. The trend toward glasses having a higher annealing point is accounted for by the advantage in higher forming rates and lower batch costs, even though lehrs must be hotter.

(c) *Strain Point.* The average strain point is 496°C. and the most common group is 490 to 500°C. The distribution of the strain point temperatures is shown in Figure 12.

(d) *Seed Counts.* The logarithmetic average number of seeds per ounce of glass is about 20. This means that the number of glasses having a seed count of less than 20 is equal to the number having a seed count greater than 20. However, the arithmetic average is 30 because 17% of the glasses have very high seed counts (50 per ounce or over).

The range in the seediness probably indicates large differences in tank loads and in fining rates of glasses. The distribution chart, Figure 13, shows that 30% of the glasses have from 0 to 10, whereas 20% have 50 to 150.

From the standpoint of appearance of containers, the size of the seeds, as well as the concentration, determines the degree of this visible defect. For practical purposes in judging container glasses, 20 seeds per ounce may be considered seed-free.

(e) *Blister Counts.* The logarithmetic and the arithmetic average blister-count is 3. No blisters were found in forty-five per cent of the glasses. This is shown in Figure 14.

Although seeds and blisters can be differentiated by definition and by origin, measurements in the laboratory can be made only on the basis of size. Bubbles that are large, unevenly distributed, and usually oblong in shape are counted as blisters. A concentration of blisters, 5 per ounce of glass or over, may be considered a visual defect in container glasses and definite indication that some reducing condition exists within the melting furnace.

(f) *Homogeneity.* The logarithmetic averages of the ring section grades is B. This is shown in Figure 15. The distribution of the percentages of glasses with respect to homogeneity follows normal logarithmetic distribution. Slightly more than fifty per cent of the glasses have ratings of B or better, and B is the most frequent grade.

(e) *Thermal Expansion.* Thermal expansion measurements were made on all glasses analyzed during 1950. The results are expressed as the coefficient of thermal expansion per degree centigrade for the range 0 to 350°, and are shown in Figure 16. The results for the 1950 glasses range from 80.8 to 100.0 x 10^{-7}. The average is 89.8 x 10^{-7}, and the most common grouping is 88.0 x 10^{-7}.

(f) *Density.* The density of container glasses for 1950 covers a wide range, 2.460 to 2.525 grams per cubic centimeter at 20°C. The large range in density reflects the range in percentages of lime and alkali in the many different types of container glasses in use.

The average density is 2.490 and the most common group is 2.495. The distribution of densities is shown in Figure 17.

It is interesting to note that the volume differences between the maximum and minimum densities is approximately 2.5% or a quarter ounce in ten ounces of glass.

VI. Summary

These data and comments are presented as a record of trends and variations among glasses used for manufacture of containers. Somewhere in the mass of data, there is probably an ideal glass or more likely several ideal glasses in reference to specifications, costs, or working characteristics. In a system made of seven to ten variables, it is not likely that a single combination is best. Nevertheless, the author anticipates further changes in the averages and eventually a decrease in the spread of results in future years. These will come about as increased reliance is placed on physical and chemical measurements as accurate means of comparing glasses.

DR. ALEXANDER SILVERMAN PRESENTS GLASS COLLECTION TO ALFRED UNIVERSITY

Fifty gift barrels and crates containing the priceless glass collection of Dr. Alexander Silverman, who has just retired as Head of the Department of Chemistry at the University of Pittsburgh, has reached New York State College of Ceramics at Alfred University to whom Dr. Silverman has presented his collection.

The collection has been 49 years in the making and is the most representative of modern glass from the standpoint of art and technology. Many are non-replaceable works of art. Countries represented in the collection are Arabia, Armenia, Austria, Belgium, Brazil, China, Czechoslovakia, England, Estonia, Finland, France, Germany, Greece, Holland, Hungary, Italy, Israel, Japan, Norway, Portugal, Russia, Scotland, Spain, Sweden, Switzerland, Syria. Glass from the United States constitutes about half of the collection.

IN THE MAKING OF FINE CHINA

Photograph Courtesy of Lenox, Inc.

• Continuous Glass Annealing Lehrs for every kind of glass • Continuous Convexing and Bending Furnaces • Continuous Decorating and Reannealing Lehrs • Continuous Conveyor Type Pottery Decorating Kilns • Special Processing Furnaces • Mould Heating Ovens • Recuperative Glass Melting Tanks • Consulting Engineering Service on All Heating Operations.

...it takes quality in material, workmanship and equipment to make quality in product. Now over 400 Surface Combustion Kiln and Lehr installations. The only lehr with controlled recirculation.

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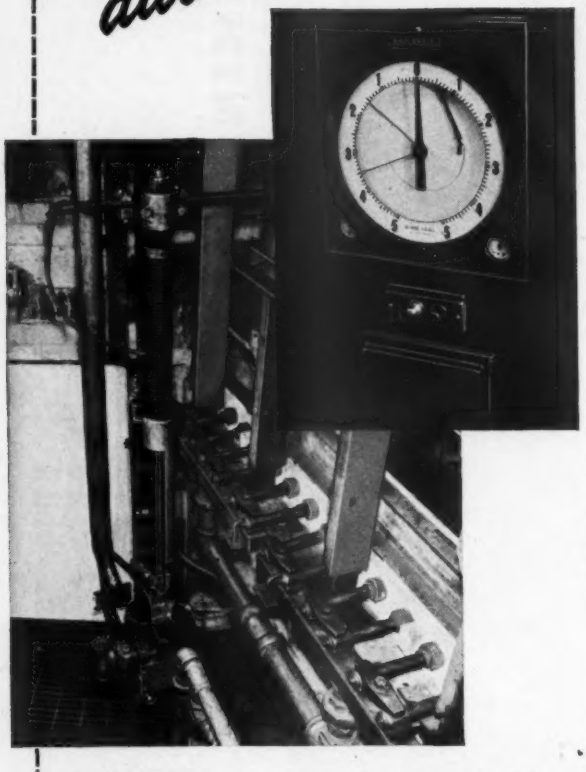
maintain glass level *automatically!*



Precision measurement and control of level in glass tanks and forehearths is no longer a major problem. Today it's done *automatically* with the Brown Glass Level Control System.

Industry-proved in numerous installations, the system provides positive assurance of correct level at all times. Regardless of the type ware being formed, size and weight are rigidly maintained . . . production is increased . . . rejects are practically eliminated.

When combined with other Honeywell control systems, additional benefits include lower operating costs, higher quality ware, increased production, fuel savings, longer tank life, longer refractory life, longer furnace campaigns.

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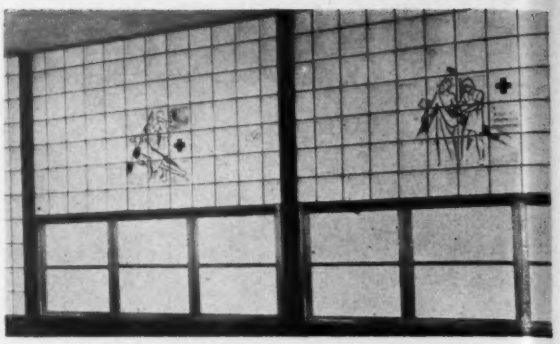

FOURTEEN STATIONS OF THE CROSS PAINTED ON GLASS

In an attempt to recapture the rich colors of the thirteenth and fourteenth century Gothic cathedrals, a modernized version of the Medieval art of stained glass has been attempted for the first time in the church and school of Saint Christopher's Catholic parish at Marysville, Michigan. Through a technique developed at Sienna Heights, Michigan, the fourteen Stations of the Cross, showing the condemnation, crucification, death, and burial of Christ, are portrayed in paintings applied directly to glass block.

The idea was originated by Sister Helene, a Dominican nun in the Art Department of Sienna Heights College, in collaboration with Melville Steinfels, Chicago artist and a former student at Sienna Heights. Together they experimented on glass block, finally evolving a method of baking the colors on the surface.

One of the most painstaking parts of the project was the preparation of charcoal sketches, drawn to scale against a background of glass block. When the charcoal sketches were completed, the individual blocks were painted with an interval in the oven between application of each color.

Each picture of the stations covers several eight-inch clear faced blocks set into the larger glass block panel in an unbalanced pattern to avoid repetitious form. The effect of the paintings, done on clear block faces and set among the translucent blocks used in the rest of the panel, is particularly striking at night as the light from within the church is reflected back through the pigments from the outer layer of blocks to give a picture that is startlingly brilliant in the surrounding darkness.

The glass block installation was supervised by Artist Steinfels, together with J. R. Nicholson and John Finn, representatives of the Pittsburgh Corning Corporation.

NEW DYE PROCESS FOR FIBROUS GLASS

A new process for dyeing fibrous glass has been developed by General Aniline and Film Corporation in cooperation with General Dyestuff Corporation and Owens-Corning Fiberglas Corporation.

In announcing the new process, J. Robert Bonnar, Technical Director of General Dyestuff Corporation, said the discovery is expected to lead to much more widespread use of fibrous glass for decorative purposes. The new dye technique increases wash-fastness, abrasion resistance, and the drapery qualities of the material, Mr. Bonnar said, but does not reduce its flame-resistant characteristics.

THE RIGHT *Color* ENHANCES BEAUTY

● Colors that flatter some women are unbecoming to others. It's just a case of finding the right color for the right individual. You may have the same problem in finding the right color to fit your ware. But here's an easy solution: Call on Drakenfeld to help you formulate colors exactly suited to the needs of your particular processing techniques and high standards.

Our broad knowledge and research facilities may hold the answer that can produce greater profits for you. For over three-quarters of a century we have been saving time, money and effort for ceramic manufacturers, large and small. Whatever your needs, whether you want colors matched, created or brought up to date, we believe our know-how can be of real value to you.

Let us demonstrate how our friendly counsel has helped others—how it can serve you. For more production and lower costs, for fewer rejects and better ware, investigate the advantages of Drakenfeld service. Write or phone for a meeting date today.

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DEPENDABLE SERVICE ON:

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DR. E. U. CONDON JOINS CORNING STAFF

Announcement has been made of the appointment of Dr. Edward U. Condon, noted nuclear physicist, as Director of Research and Development of Corning Glass Works. The announcement by William C. Decker, President, and Dr. Jesse T. Littleton, Vice President and present Director of Research and Development, was coincident with the recent acceptance by President Truman of Dr. Condon's resignation, effective September 30, as Director of the National Bureau of Standards in Washington, D. C.

The announcement stated that the appointment of Dr. Condon to direct Corning Glass Works' broad research and development activities is another step in the maintenance of the company's position as a leader in glass research and the manufacture of technical and consumer glassware. It was also noted that Dr. Littleton will become general technical adviser. In this capacity he will be available to all departments of the company and its subsidiaries for advice on technical problems.

Dr. Condon was appointed Director of the National Bureau of Standards by President Truman in November 1945 and simultaneously began giving full time service as scientific adviser to the Special Committee on Atomic Energy of the U. S. Senate. In the summer of 1946 he attended the Naval atomic bomb tests at Bikini as a member of the President's Evaluation Board.

As Director of the National Bureau of Standards, he has been responsible for important contributions to the Department of Defense and the War Emergency Program. Some of the Bureau work under Dr. Condon has included research in atomic physics, guided missiles, and proximity fuses. He has also directed other valuable work in connection with electronic computers and applied mathematics in relation to military needs.

Prior to his appointment to the National Bureau of Standards, Dr. Condon spent eight years as associate director of research for Westinghouse Electric Corporation. He was born at Alamogordo, New Mexico, in 1902 and attended the University of California where he was granted his Ph.D. in physics in 1926. He then spent a year of study in Germany as a fellow of the International Education Board. On his return, he taught physics at Columbia, Princeton, and the University of Minnesota. In 1930, he became associate professor at Princeton and in 1937, he left to join Westinghouse.

He is Chairman of the Senate's Advisory Committee on Color Television and Chairman of the Federal Specifications Board. He is a member of the Physics Committee of the Board of Overseers of Harvard University, the Advisory Council to the Department of Electrical Engineering of Princeton University, and the Board of Visitors to Union College. He was a member of the President's Evaluation Board for Operations Crossroad and Chief of the U. S. Delegation to the International Conference on Weights and Measures.

Dr. Condon is co-author of two of the basic textbooks on atomic physics in addition to a long series of technical papers. Appointed a consultant to the National Defense Research Committee in 1940, he helped to organize the radiation laboratory at Massachusetts Institute of Technology where America's radar program was developed. During World War II, he introduced and directed the radar research program at Westinghouse Electric Corporation. Later, at Berkeley, California, he was occupied full time on the atomic bomb project. Earlier he had written an outline manual on atomic energy for use of scientists at Los Alamos. He is a member of the National Advisory Committee for Aeronautics and a member of the Scientific Committee of the Brookhaven National Laboratory, a government project concentrating an basic research and peacetime application of atomic energy.

Dr. Littleton joined Corning Glass Works as a physicist in 1913. He received his A.B. degree at Southern University in Alabama in 1906; his M.A. from Tulane University two years later; and his Ph.D. at the University of Wisconsin in 1911. Prior to coming to Corning he served as instructor in Physics at the University of Michigan for two years.

In 1920, Dr. Littleton was made chief of the physical laboratory at CGW, a post he held for twenty years. He was appointed Assistant Director of Research in 1940 and three years later was elected Vice President and Associate Director of Research. In 1946, he became Director of Research and Development.

Dr. Littleton is a member of Sigma Psi and Gamma Alpha, honorary scientific fraternities. He is a member and a fellow of numerous scientific societies, and was one of two scientists from this country invited to address the International Glass Congress in London in July 1936. In 1944, Dr. Littleton was awarded the honorary degree of Doctor of Science by the University of Wisconsin.

He has received many patents on glass products and processes during his long years of association with Corning Glass Works and his authorship has added valuable contributions to the literature of glassmaking.

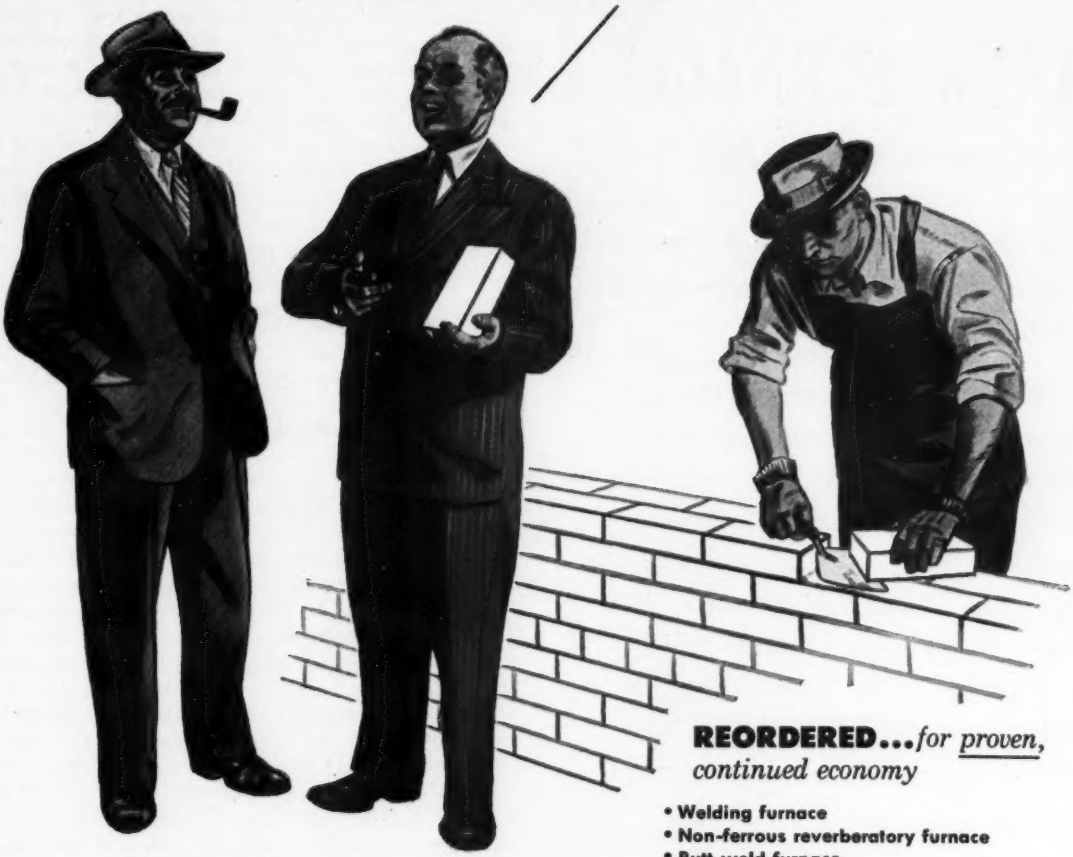
AMERICAN POTASH ADDS TO STAFF

The appointment of two new assistant vice presidents as part of its continuing expansion program has been announced by American Potash & Chemical Corporation.

Parker Dunn, who resigned as resident manager for the Potash Company of America to accept the new post, will report to the Vice President in charge of Technical Operations. Mr. Dunn will be concerned with plant operations. Prior to his present connection, he was associated with Southern Alkali Corporation, Pittsburgh Plate Glass Company, and Mead Corporation. Mr. Dunn is a graduate of Ohio State University and received his master's degree from Massachusetts Institute of Technology.

Thomas F. Edson, whose last position was Executive Assistant for Victor Chemical Works, will report to the Vice President in charge of Research and Development. Mr. Edson was formerly associated with A. R. Maas Chemical Company for 15 years, advancing from plant engineer to executive vice president. His earlier background includes three years at the American Potash & Chemical Corporation plant at Trona, as well as service with Firestone Tire & Rubber Company and Union Oil Company. He is a graduate of the California Institute of Technology.

"B&W Allmul Firebrick keeps saving money for me!"



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DIAMOND ALKALI EXPANSION PROGRAM

A two-year multi-million-dollar program of plant expansion at the Painesville, Ohio, plant of Diamond Alkali Company has been announced by Raymond F. Evans, President. The project, he said, embraces extensive enlargement and modernization of present facilities which will enable the company to step-up output of caustic soda and chlorine substantially by the electrolytic method. It also includes construction of a new plant for producing perchlorethylene, a chlorinated hydrocarbon solvent whose industrial applications have soared in recent years.

An expansion project is also being planned at Diamond Alkali Company's silicate of soda plant at Dallas, Texas. W. H. Evans, the company's General Manager of silicate operations, stated that "this is the fourth time within 10 years that the plant has been expanded to meet the ever-growing demand for Diamond chemicals in the booming southwest."

The Dallas project, estimated to cost several hundred thousand dollars, calls for the installation of a large furnace to supplement the production of three smaller type furnaces now in operation. The present furnace building will be remodeled to accommodate the expanded facilities.

Further expansion by Diamond is seen in the pending acquisition by it of Kolker Chemical Works, Inc. of Newark, New Jersey. The firm has made arrangements to obtain all of the common capital stock of Kolker in exchange for 33,500 shares of Diamond's common stock, subject to approval by Diamond shareholders at a special meeting. In making the announcement, Mr. Evans, Diamond President, stated that if the acquisition is made, no change in Kolker's management is contemplated.

The acquisition of the Kolker firm, Mr. Evans pointed out, would diversify Diamond's present line of over 100 chemicals in a logical direction. Kolker, with plants at Newark, New Jersey, and Houston, Texas, manufactures a line of organic insecticides and agricultural chemicals, and its sales presently are at the rate of $7,000,000 per year.

Also to be passed on at the special meeting of Diamond shareholders is a proposed two-for-one split of Diamond's capital stock recommended by the Board of Directors.

NEW L-O-F HEAT-ABSORBING PLATE GLASS

A new and improved heat-absorbing plate glass has been produced by Libbey-Owens-Ford Glass Company and is now being put on the market, it has been announced by G. P. MacNichol, Jr., Vice President in Charge of Sales.

The new glass is a product of special chemical composition, pale bluish-green in color, has the same glare reducing properties of the first heat-absorbing glass introduced by L-O-F ten years ago, but with greater resistance to thermal shock.

Mr. MacNichol states that the glass technologists have perfected this new glass so that it has a reduced coefficient of expansion and does not absorb quite so much of the radiant energy in sunlight as the more primitive types of heat-absorbing glass. The new polished plate glass manufactured in the $\frac{1}{4}$-inch thickness has a transmittance of 76.5 to 79 per cent of average daylight, but it permits only 42 to 50 per cent of the total radiation of the sun to pass.

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4. Furnace life is extended since gypsum does not form a transitory gall. Side wall refractories are free from attack encountered with other fining agents. Other refractory advantages are effected with flux bottom blocks and even electrocast side walls.
5. Absence of transitory gall and low iron content of gypsum insures a minimum of selenium volatilization.
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INVENTIONS AND INVENTORS . . .
(*Continued from page* 465)

Lorenz. The usual tong jaws are replaced by a pair of bars 31 and these bars carry a row of spring fingers 37 which are actuated by the usual mechanism. The fingers yield independently to accommodate variation in the diameter of the ware and to engage ware which may be slightly out of line.

The patent contains five claims and the seven references cited were 197,135, Hunting, Nov. 13, 1877; 832,087, Scoggins, Oct. 2, 1906; 851,631, Swanson, Apr. 23, 1907; 883,563, Parrish, Mar. 31, 1908; 1,493,480, De Tour, May 13, 1924; 2,072,826, Riley, Mar. 2, 1937; and 2,277,828, Morgan, Mar. 31, 1942.

Tipping-off Method for Exhaust Tubes, Fig. 8. Patent No. 2,561,838. Filed Oct. 28, 1949. Issued July 24, 1951. One sheet of drawings. Assigned to General Electric Company by C. E. Bechard.

The usual method of tipping-off exhaust tubes sometimes results in faulty seals due to thin spots or lumps of glass which are liable to break. This patent shows a method of making a tip-off as shown in section in the figure which is said to be much more reliable.

The patent contains two claims and the references cited were 1,984,488, Mulder, Dec. 18, 1934 and 2,247,513, Marshaus, July 1, 1941.

Shaping Glass Tubes. Patent No. 2,561,859. Filed Nov. 3, 1949. Issued July 24, 1951. One sheet of drawings, none reproduced. Assigned to General Electric Company by Alfred Greiner.

This is a method of making a U-shaped tube for fluorescent lamps in which the legs of the tube are very close together. This has heretofore been done by heating and bending a straight tube. According to this invention, two tubes are placed side by side, the ends to be connected are heated, and the adjacent ends are cut by shears which connect the tubes where the cut is made. The lower end of the tubes thus joined is heated and sealed. The final shape of the U-bend is made in a mold while air pressure is applied inside the tubes. This is said to form a U-shaped turn much stronger than that made by the bending process.

The patent contains six claims and no references were cited.

Bead Machine. Patent No. 2,562,932. Filed Aug. 11, 1948. Issued Aug. 7, 1951. Four sheets of drawings, none reproduced. M. C. Meyer and Stanley Wechsler, inventors.

This machine comprises means for gripping and feeding a wire intermittently into position below a glass rod, the lower end of which is melted by suitable burners. The wire is rotated and moved vertically so that the molten glass is wound around it. Means is provided for varying the size of the beads. The wire is later dissolved or pulled out of the bead and it may also be annealed in the same machine.

The patent contains two claims and the references cited were 2,348,035, Synek, May 2, 1944 and 624,239, France, July 11, 1927.

• William E. Nobbe, Director of the Patent Department of Libbey-Owens-Ford Glass Company, has been elected President of the Toledo Patent Law Association for the fiscal year 1951-52.

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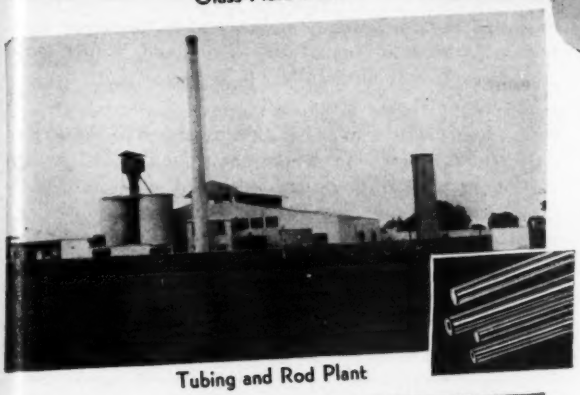
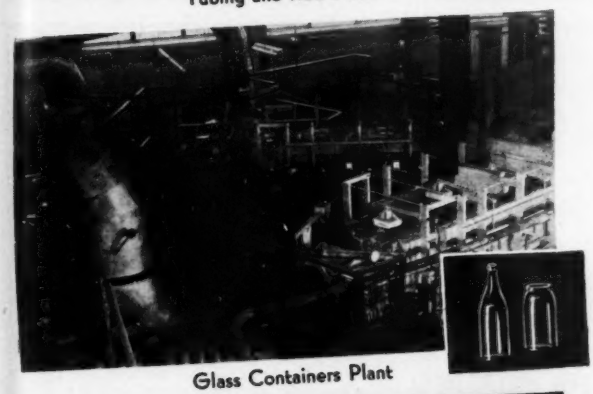


Tubing and Rod Plant



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DIVERSIFIED GLASS PAPERS SCHEDULED FOR COMING A.C.S. WEST COAST MEETING

The interesting and highly informative papers on glass to be presented before the coming Pacific Coast Regional Meeting of the American Ceramic Society promise to draw the attention of glass technologists all over the country. The meeting, which is the fourth such convention held on the Coast, is scheduled for October 24 through 26 with headquarters at the Wilton Hotel, Long Beach, California.

Victor C. Swicker, Chairman of the Glass Division, Southern California Section of the Society, is in charge of the panel of technical papers on glass for the convention. A stellar feature of the program will be the appearance of Howard R. Lillie, President of the American Ceramic Society, who, in addition to giving a message of greeting from the National Society on the opening day, will present a highly informative paper on glass viscosity. Other papers on the program will include the subjects of industrial engineering applied to glass plants, economic status of the glass industry, a description of a local silica sand mine, and incentive plans in employee-employer relations.

Program highlights, in addition to President Lillie's message, will include an address of welcome by Clark Sutherland, Chairman of Southern California Section, the host section of the convention. J. E. "Jake" Eagle, speaking on the topic "Critical Material Shortages," will keynote the program.

Highly informative panels on glass will be included in each of the technical sessions to be held on the afternoon of the first day, the morning and afternoon of the second day, and the forenoon of the convention's closing day. Motion picture films of new processes, exhibits of new glass products and glassworking equipment, as well as open forum discussions of glass problems will round out the program of technical papers.

Scene of the forthcoming meeting with Municipal Auditorium at water's edge at left center and Wilton Hotel directly in the rear.

Glassmen will have their special section of tables at the convention banquet, to be held on the night of October 25th, at the Wilton Hotel. All technical sessions are

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to be held at the Municipal Auditorium, adjacent to the Wilton Hotel. The Auditorium has been made available through the courtesy of the Long Beach Convention and Visitors Bureau.

E. E. "Ed" Kunzman, Chairman-elect of Southern California Section, is General Convention Chairman, assisted by R. A. Haecker, Technical Chairman; Corena Sherrill, Ladies' Entertainment; Dick Iander, Publicity Chairman; George Middleton, Alumni Arrangements; Jim Tetrault, Banquet, and Homer Dye, First Day Arrangements.

KYANITE AND MULLITE MEETING

Supply and requirements problems affecting U. S. production of kyanite and mullite were reviewed at a recent organizational meeting of the Kyanite and Mullite Industry Advisory Committee with the National Production Authority.

Most of the production problems facing the industry now, the committee said, are due to a growing shortage of kyanite imported from India, the world's major producer of this important mineral. Primarily responsible for this situation are a tightening of controls by the Indian Government over the export of kyanite and the willingness of foreign purchasers to buy available kyanite at a higher-than-domestic price.

The committee generally agreed that kyanite with 60 per cent aluminum content is required to produce a superior refractory product and that material which falls below this standard cannot be used in American production. The industry was informed that the Indian Government is making available 30,000 tons of relatively high-grade kyanite for export annually. Export licenses will be issued on a "first come, first served" basis, according to information from India.

To help relieve the industry's dependency on natural kyanite, American manufacturers are expanding their facilities for producing synthetic mullite, the committee said. The synthetic product already has been used for many refractory purposes and has proved entirely satisfactory. The facilities, when completed, will be capable of replacing calcined kyanite in most industrial uses in the event of an all-out emergency.

Because the industry already has taken measures to conserve supplies of kyanite and mullite, no conservation order is needed at the present time, the committee suggested.

Harry B. Sharpe, Acting Director of NPA's Miscellaneous Metals and Minerals Division presided. Committee members who were present were: M. C. Booze, The Chas. Taylor Sons Company; Gene Dixon, Kyanite Mining Corporation; A. E. Fitzgerald, General Refractories Company; Charles W. Fyfe, Seaboard Refractories Company; Henry A. Golwynne, The Mullite Refractories Company; C. E. Hawke, The Carborundum Company; L. C. Hewitt, Laclede-Christy Company; G. Brickley Remmey, Richard C. Remmey Son Company; and C. L. Norton, Jr., The Babcock & Wilcox Company.

• F. M. Hernan, controller of the Anchor Hocking Glass Corporation, has been elected a Director of the Columbus Control of the Controllers Institute.

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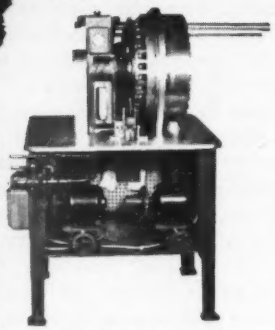

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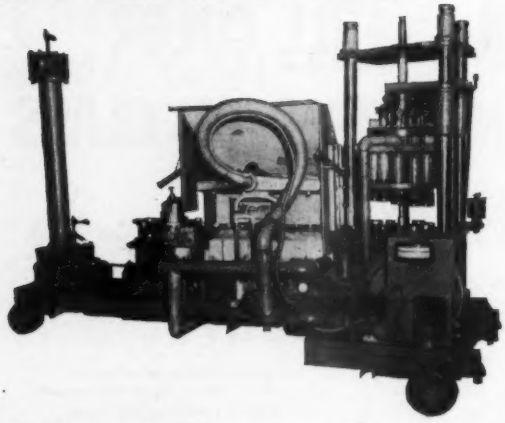

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SOUTHERN ALKALI CORPORATE NAME CHANGED

The corporate name of Southern Alkali Corporation will be changed to Columbia-Southern Chemical Corporation effective September 1. A wholly-owned subsidiary of Pittsburgh Plate Glass Company, the firm is a producer of soda ash, chlorine, caustic soda, and related chemicals. Plants are located at Barberton, Ohio; Corpus Christi, Texas; Natrium, West Virginia; Lake Charles, Louisiana; and Bartlett, California.

Clarence M. Brown, Chairman of the Board of Directors for both Pittsburgh Plate Glass Company and Columbia-Southern Chemical Corporation, stated that the action involves a change in name only. He said that personnel, policies, and customer relations will not be affected.

BATTELLE ESTABLISHES EUROPEAN BRANCH

Battelle Institute has announced the establishment of a European branch of its laboratories to serve the European economy. According to Battelle Director Clyde Williams, the decision follows a recently completed survey of scientific and industrial conditions in Europe.

Since 1929 Battelle has served American industry through science and technology at its Columbus, Ohio, laboratories and it is its plan to now serve European industry in the same manner.

The exact location of the European branch and other details will depend upon the outcome of negotiations now in progress.

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A.C.S. REFRACTORIES DIVISION TO HOLD TWO-DAY FALL MEETING

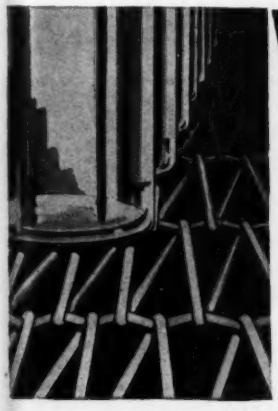
The Refractories Division of the American Ceramic Society has scheduled its two-day Fall Meeting at Bedford Springs Hotel, Bedford, Pa., September 14 and 15. Highlighting the meeting will be an *off-the-record* discussion of plant problems. The September 14 unrecorded discussion should give plant men ample opportunity to air basic problems, hear others tell theirs, and arrive at sound conclusions as to improvements in their products.

Major topics to be discussed are "Palletizing of Refractories", "Oil Fire in Tunnel and Periodic Kilns", "Effectiveness of Strain Gauges for Controlling Density in Dry-Press Products", and "Construction and Refractories for Tunnel Kiln Car Tops". Included on the program is a paper "Six Variations in Glass Furnace Brick".

ANNUAL REPORT AWARDS

From the 5,000 corporation annual reports for 1950 rated in the Eleventh Annual Survey conducted by Weston Smith, *Financial World*, nine glass companies have qualified for "Highest Merit" citations. They are American Optical Company, American Window Glass Company, Anchor Hocking Glass Corporation, Bausch & Lomb Optical Company, Corning Glass Works, Glass Fibers, Inc. Libbey-Owens-Ford Glass Company, Pittsburgh Plate Glass Company, and Univis Lens Company.

The stockholder reports of these companies have thus become candidates for the final judging and one will be selected for a "Best of Industry" award.



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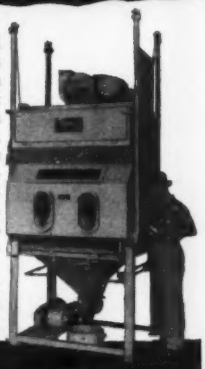

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